PROCEEDINGS OF THE

Fourteenth Annual Convention

OF THE

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS

HELD IN

CHICAGO, ILL.

October 18, 19, and 20, 1904

CONCORD, N. H.
THE RUMFORD PRESS
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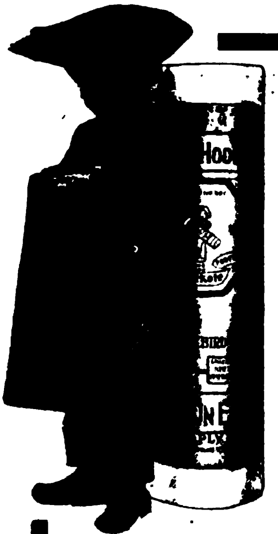
PAGE 199.

Reference to figure 38 should have been to figure 38 *a*.



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Boston & Maine Railroad.

Arthur Montzheimer . . . . Joliet, Ill.
Elgin, Joliet & Eastern Railway.

COMMITTEES FOR 1904-1905.

COMMITTEES ON SUBJECTS FOR REPORT AND DISCUSSION.

I. Construction and maintenance of docks and wharves.

H. Rettinghouse, Foreman B. and B., C. & N. W. Ry., Kaukauna, Wis., Chairman.
W. A. McGonagle, D., M. & N. Ry., Duluth, Minn.
A. A. Page, B. & M. R. R., Boston, Mass.
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L. J. Anderson, C. & N. W. Ry., Escanaba, Mich.
L. D. Smith, G. C. & S. F. Ry., Galveston, Tex.

II. Relative value of concrete and timber piles.

W. H. Finley, Prin. Asst. Engr., C. & N. W. Ry., Chicago, Chairman.
J. C. Hain, C., M. & St. P. Ry., Chicago.
W. A. Rogers, Manhattan Building, Chicago.
D. W. Lum, Southern Ry., Washington, D. C.
W. S. Dawley, Frisco System, Chicago.
L. F. Goodale, C., B. & O. Ry., St. Louis, Mo.

III. Concrete building construction, including platforms.

C. W. Richey, Master Carpenter, Pennsylvania R. R., Allegheny, Pa., Chairman.
A. O. Cunningham, Wabash R. R., St. Louis, Mo.
C. F. Loweth, C., M. & St. P. Ry., Chicago.
G. A. Wright, C. & E. I. R. R., Danville, Ill.
F. P. Gutelius, C. P. Ry., Montreal, Que.

IV. Anchors for plows and derricks.

R. J. Arey, Asst. Engr., A., T. & S. F. Ry. (Coast Lines), Williams, Ariz.. Chairman.
A. J. Ross, G., H. & S. A. Ry., El Paso, Texas.
E. Loughery, Texas & Pac. Ry., Marshall, Texas.
M. Bishop, C. R. I. & P. Ry., Chickasha, I. T.

V. Methods of repairing roofs of various kinds.

J. N. Penwell, Supvr. B. and B., L., E. & W. R. R., Tipton, Ind., Chairman.
A. W. Merrick, C. & N. W. Ry., Boone, Iowa.
G. C. Larson, C., St. P., M. & O. Ry., Spooner, Wis.
H. W. Phillips, N. Y., N. H. & H. R. R., South Braintree, Mass.
C. F. Flint, Central Vermont R. R., St. Albans, Vt.
Floyd Ingram, L. & N. R. R., Erin, Tenn.

VI. Methods of watering stock in transit.

J. O. Thorn, Supt. B. and B., C., B. & Q. Ry., Beardstown, Ill., Chairman.
B. J. Sweatt, C. & N. W. Ry., Boone, Iowa.
F. O. Draper, Ill. Central R. R., Freeport, Ill.
F. Ingalls, Northern Pac. Ry., Jamestown, N. D.
F. L. Park, C., R. I. & P. Ry., Topeka, Kansas.

VII. Protection of water tanks and water pipes from action of frost.

J. P. Canty, Supvr. B. and B., B. & M. R. R., Fitchburg, Mass., Chairman.
J. Parks, Union Pacific Ry., Denver, Col.
A. Findley, Canadian Pac. Ry., Montreal, Que.
F. L. Burrell, C. & N. W. Ry., Fremont, Neb.
K. J. C. Zinck, C. R. I. & P. Ry., Des Moines, Iowa.

VIII. Recent practice in coffer dam work.

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F. E. Schall, L. V. R. R., South Bethlehem, Pa.
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D. C. Zook, Pa. Lines W. of Pittsburg, Fort Wayne, Ind.
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J. H. Howe, Union Pac. R. R., Omaha, Neb.

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C. F. King, C. & N. W. Ry., Norfolk, Neb.
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Walter Hurst, C., B. & Q. Ry., St. Joseph, Mo.
Burton Marye, Southern Ry., Richmond, Va.

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E. Fisher, Mo. Pac. Ry., Pacific, Mo.
J. C. Beye, Union Pacific R. R., Kansas City, Mo.
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Ed. Gagnon, M. & St. L. R. R., Minneapolis, Minn.
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A. Shane, T., St. L. & K. C. R. R., Frankfort, Ind.
G. J. Bishop, G. T. Ry., Durand, Mich.

COMMITTEE ON APPLICATIONS FOR MEMBERSHIP.

Grosvenor Aldrich, N. Y., N. H. & H. R. R., Readville, Mass., Chairman.
W. O. Eggleston, Erie R. R., Galion, O.

COMMITTEE ON RELIEF.

A. Montzheimer, E., J. & E. Ry., Joliet, Ill., Chairman.
James Stannard, Wabash R. R., Moberly, Mo.
M. Riney, C. & N. W. Ry., Baraboo, Wis.
J. B. Sheldon, N. Y., N. H. & H. R. R., Providence, R. I.

COMMITTEE ON ENTERTAINMENT.

H. W. Fletcher, 2376 California Ave., Allegheny, Pa.
G. H. Soles, P. & L. E. R. R., Pittsburg, Pa.

COMMITTEE ON MEMOIRS.

J. H. Cummin, Long Island R. R., Jamaica, N. Y.

this very respectable organization and to tender to the visiting delegates a hearty welcome to Chicago. In this city, a great cosmopolitan aggregation of peoples from the ends of the earth, we talk forty-three different languages, and the mayor insisted that I should say "Welcome" to you in all these different tongues. I would very cheerfully do so, only I fear that I might embarrass you. This union or Association of yours, I presume, without knowing exactly its entire purpose or the area of the idea that it covers, is nevertheless in the general spirit and trend of the unionism that prevails all over the country, in fact, all over the civilized world, which is one of the phenomena of this new century, and which is in effect a touching of elbows along certain lines and for certain purposes.

A friend of mine not long ago, who had heard repeated the old story from Esop's Fables of how a father taught his sons the value of union by taking a bundle of rods, and drawing out a rod, easily broke it, but taking all the rods in the bundle showed his sons that they could not thus be broken, said that he had but one comment to make on this story. He said, "If I had been there, I would have taken that bundle apart and given each one of those boys a rod and told him to go out and obtain union with it, peaceably, if possible, or forcibly if necessary." I have heard a story, I will not vouch for it, being a careful sort of a man, of a member of a labor union who was sent out on the West Side to do picket duty, and by and by he came into headquarters and his superior said to him, "Well, did you see any scabs down there?" "I did; there was one of them came poking into the factory by the back way, and I was not more than ten feet away from him. I reached down and grabbed a brick and was going to paste him one, when a second thought came over me and I said, 'No, I will not do it.'" "Well, why not, were you too tender hearted?" "Naw, but I happened to glance at the brick and I saw that it was a non-union made brick, and I wouldn't use it." (Laughter.)

It is, as I say, the age of unions, and without being ac-

quainted at all with the precise details of your Association, I dare say that your object in coming to Chicago is to interchange ideas, and find the more efficient ways of doing things, and in this way support each other and hold each other up, perhaps from the fear that if you did not someone else would hold you up. That reminds me of a little *bon mot* I heard the other day. A man came running into a police station and said, "What kind of a town is this Chicago, anyway? I was held up right in front of a hotel." The police captain said, "My friend, you haven't very much room to complain. While you are the only man that I have heard of being held up on the outside of a hotel, I have heard of a great many that have been held up inside of a hotel." (Laughter.)

We welcome you. You are entitled to a welcome. Chicago's motto, as you know, is "I will." Out of modesty and perhaps out of pure equity that motto ought to be amended somewhat. It ought to be "We will," for as a matter of fact, Chicago stands without precedent and without peer in the world for rapidity and substantiality in its growth; but it did not exactly build itself. It is the joint contribution of the peoples from all over the country. They have been plowing for us and reaping for us in the great wheat and grain fields; they have been raising cattle for us on a thousand hills; the railroads have been building for us a web of converging lines from the east and west and north and south; they have all been helping to build this city of Chicago, nine miles wide, twenty miles long and at places twenty-two stories high. It is our pride. Make yourselves at home; you are at home. Critics sometimes say that we are a very dirty town. True; we are compelled to admit it; in fact, we admit it with a little pride, because, after all, our phenomenal dirt is due to the fact that converging lines of business men from all the cities of the union have been bringing their dirt in here. (Laughter.)

We hope that you will have a good time while you are in Chicago. It is one of the unwritten ordinances of the city

that you must have a good time, and if you fail of it your local society of the bridge men in the city will be held responsible by his honor, the mayor, and the municipal government. We have plenty to entertain you. It is true we are a very tense business people. I heard a little while ago of an instance that illustrates this. Every once in a while we have an explosion of sewer gas that blows up a manhole, and not long since it happened that when one of these explosions came a couple of gentlemen who were standing on one of these manholes were blown up. One of them was a Chicago man, and way up in midair he grabbed the other one by the lapel and tried to sell him a bill of goods! While we are devoted to business, I think it is true that we are equally as interesting from the social side, and I beg of you again, if your local gentlemen fail to entertain you, report it promptly over to the headquarters of the detective bureau and let it come to my department and I will attend to it. We are a new town and yet we are not given entirely to the merely material sides of life; we are a packing town and yet our talk is not entirely of beef and pork. You will find that alongside of these great industries that mark our city there are some of the greatest universities of the world, museums of art, institutes, schools of technology, parks, everything that could inform the mind or delight the taste; and, while you are here, I take it that it will be part of your programme to look around the town a little and to find out some of the many sides of this great city of ours.

But, ladies and gentlemen, I must not detain you. Your business is far more important than any scattering or desultory remarks of mine, however well intended. Once more, in behalf of Mayor Harrison and the City of Chicago, I bid you a hearty welcome, and express the earnest desire and hope that your meeting may be profitable and pleasant to the highest degree. Gentlemen, I thank you. (Applause.)

President.—We certainly are very grateful to Dr. Taylor

for his cordial welcome. It is not my province to talk very much at this Convention, as I am supposed to sit still and listen, so I am going to call on one of our members to make a response. Before doing so I will refer to one or two topics mentioned by Dr. Taylor. I did not suppose he would say anything about the hold-up business, as that is rather a touchy subject with a Chicago man, and I certainly thought he would assure us that if we were held up, he would help us out, considering that he is connected with Chicago's law department. I never knew before where all the dirt in Chicago came from, but we all knew it was pay dirt. I will ask Mr. J. H. Cummin of the Long Island Road to make the response.

Mr. Cummin.—Dr. Taylor, I believe that I voice the sentiments of every member of this association when I assure you that we thank you heartily for the welcome that you have tendered us as an association. While I sat here listening to your eloquent remarks and realized that perhaps the president might call on me to say some few words in return, trying to think what it would be, and saw the satisfied smile of satisfaction with which you concluded, I realized that I was in the position of the boy who ran away from school and went fishing. Along about dusk he was sneaking home, when one of his lady neighbors saw him and said, "Johnnie, is that you? Well you'd better be running home quick, for your mother is worrying about you." Johnnie said, "Aw, you don't need to bother about her. Her troubles are about over; mine are just beginning." I do not know why our president should call on me to respond to your remarks, Dr. Taylor, when I look around at the members of this Association and see my friends Andrews and McGonagle and many others, who are so gifted with speech. When I first became a member of this Association some years ago, I realized my deficiencies in this respect after listening to their remarks and I made up my mind that I would try to remedy them and see if I could not fit myself to get up and talk in public assemblies. I thought for a time that I was

succeeding very well, but from some remarks which I have heard dropped I am afraid I am in the position of a young man in a country town who thought that in him the stage had lost one of its brightest stars. The Young People's Association there was giving an entertainment and he proffered his services and said he would give them an imitation of a celebrated actor. On the day the performance was to come off this actor happened to come through the town, and seeing his name on the bills, concluded to stop over and witness the imitation. Just as he had concluded, one of his listeners told him that Mr. So and So was in the audience. He made his way to him and asked him, "How did you enjoy my imitation?" The reply was, "If that is a good imitation, my performance must be rotten." (Laughter.) Dr. Taylor, we have a union here, a union of strong men and firm friendships, differing possibly from the majority of unions which you have met in your great city. We do not meet here to consider the wage question, or the hour question, but to devise ways and means, and consult with one another as to how we can fit ourselves to grow still higher and higher in the profession which we have adopted. That is the object with which we have met here, and at all our meetings at different times. We all claim to be practical men, we strive to be practical men, and while we appreciate the benefit that theory can give us, yet we realize that in our department, at least, theory is of no value without practical experience to help us out, and that is the object of our meeting here. I thank you kindly, sir, in behalf of the Association for your warm words of welcome, and I know we shall appreciate the benefits we shall derive through our visit to this great City of Chicago. (Applause.)

President.—Next on the programme is the roll-call.

Secretary Patterson then called the roll and the following members responded:

ROLL-CALL.

PRESENT.

ALDRICH, GROSVENOR, N. Y., N. H. & H. R. R., Readville, Mass.
ALEXANDER, W. E., Bangor & Aroostook Railroad, Houlton, Me.
ANDERSON, L. J., C. & N. W. Ry., Escanaba, Mich.
ANDREWS, GEO. W., B. & O. Ry., Baltimore, Md.
ASHBY, E. B., L. V. R. R., So. Bethlehem, Pa.
AUSTIN, CYRUS P., Boston & Maine R. R., Medford, Mass.
BEAHAM, WILLARD, C. & N. W. Ry., Winona, Minn.
BISHOP, GEO. J., G. T. Ry., Durand, Mich.
BROWN, EBENEZER, G. T. Ry., Allandale, Ont.
BURRELL, F. L., C. & N. W. Ry., Fremont, Neb.
CANTY, JOHN P., Fitchburg Div., B. & M. R. R., Fitchburg, Mass.
CARR, CHARLES, Michigan Central R. R., Jackson, Mich.
CARPENTER, JAMES T., St. Louis Div., Southern Ry., Princeton, Ind.
CLARK, WILLIAM M., St. L. Div., B. & O. R. R., Warren, Ohio.
CUMMIN, JOSEPH H., Long Island R. R., Jamaica, N. Y.
CRANE, HENRY, C. & N. W. Ry., Janesville, Wis.
EGGLESTON, WILLIAM O., Cincinnati Div., Erie R. R., Galion, Ohio.
EGGLESTON, H. H., Cent. Ind. Ry., Anderson, Ind.
FLETCHER, HOLLAND W., 2376 California Ave., Allegheny, Pa.
HALSEY, W. C., C. & N. W. Ry., Eagle Grove, Ia.
HART, A. J., C., M. & St. P. Ry., Minneapolis, Minn.
HARWIG, WILLIAM E., Lehigh Valley R. R., Phillipsburg, N. J.
HEFLIN, R. L., Lehigh Valley R. R., Sayre, Pa.
HENSON, H. M., Chesapeake & Nashville R. R., Gallatin, Tenn.
HORNING, HENRY A., Mich. Cent. R. R., Niles, Mich.
HULL, K. S., Gulf, Col. & S. F. Ry., Beaumont, Texas.
INGALLS, F., Nor. Pac. Ry., Jamestown, N. D.
KEITH, HERBERT C., McArthur Bros. Co., Chicago, Ill.
KELLY, C. W., C. & N. W. Ry., Boone, Ia.
KILLAM, A. E., Intercolonial Ry., Moncton, N. B.
KING, A. H., Oregon Short Line R. R., Salt Lake City, Utah.
LARGE, C. M., Erie & Pittsburg Ry., Jamestown, Pa.
LEAKE, THOMAS S., Ill. Cent. R. R., 902 No. 1 Park Row, Chicago, Illinois.
LEAVITT, FRANK J., Boston & Maine R. R., Sanbornville, N. H.
LICHTY, C. A., C. & N. W. Ry., Fond du Lac, Wis.
LILLY, G. O., Ill. Cent. R. R., Carbondale, Ill.
LOUGHNANE, GEORGE, C. & N. W. Ry., Mason City, Ia.
MARKLEY, AARON S., Chicago & Eastern Ill. R. R. Co., Danville, Ill.
MARKLEY, JOHN H., Toledo, Peoria & Western Ry. Co., Peoria, Ill.
McCORMACK, J. W., C., St. P., M. & O. Ry., Altoona, Wis.

McGonagle, W. A., Vice-Pres., D. M. & N. Ry., Duluth, Minn.
McIntyre, James, 136 Sawtelle Ave., Cleveland, Ohio.
McKee, R. J., Ill. Cent. R. R., Clinton, Ill.
McLean, Neil, C. & E. Ry., Huntington, Ind.
McNab, A., Pere Marquette R. R., Holland, Mich.
Merrick, A. W., Chicago & North Western Ry., Boone, Ia.
Miller, A. F., Penn. Lines West of Pitts., 38 W. Van Buren St., Chicago, Ill.
Montzheimer, Arthur, Chief Engr., E., J. & E. Ry., Joliet, Ill.
Noon, W. M., Duluth, South Shore & Atlantic Ry., Marquette, Mich.
Patterson, Samuel F., Boston & Maine R. R., Concord, N. H.
Parker, J. F., Santa Fe Ry., San Bernardino, Cal.
Penwell, John N., L. E. & W. Ry., Tipton, Ind.
Powers, George F., C., L. S. & E. Ry., South Chicago, Ill.
Reed, William, Jr., Ill. Cent. R. R., Fort Dodge, Iowa.
Reid, R. H., L. S. & M. S. Ry., Cleveland, Ohio.
Rettinghouse, H., C. & N. W. Ry., Kaukauna, Wis.
Riney, M., C. & N. W. R. R., Baraboo, Wis.
Rogers, Walter A., C. E., 1203 Manhattan Building, Chicago, Ill.
Sattley, R. C., C. & N. W. Ry., Chicago, Ill.
Schall, Frederick E., Bridge Engr., Lehigh Valley R. R., South Bethlehem, Pa.
Schwartz, John, C., St. P., M. & O. Ry., Emerson, Neb.
Shane, A., Toledo, St. L. & Kansas City R. R., Frankfort, Ind.
Sheldon, J. B., New York, New Haven & Hartford R. R., Providence, R. I.
Smith, Gilman W., American Bridge Co., 13 Monadnock Block, Chicago, Ill.
Smith, W. E., Chicago, Mil. & St. P. Ry., 752 Augusta St., Chicago, Ill.
Smith, L. D., Gulf, Colorado & Santa Fe R. R., Cleburne, Texas.
Soles, G. H., Pitts. & L. E. R. R., Pittsburg, Pa.
Steffens, Wm. F., Asst. Engr., N. Y. C. & H. R. R. R., 5 Vanderbilt Ave., N. Y. City.
Stern, I. F., Gen. Bridge Insp., C. & N. W. Ry., Chicago, Ill.
Sweatt, B. J., C. & N. W. Ry., Boone, Ia.
Trippe, H. M., C. & N. W. Ry., Chicago, Ill.
Vandergrift, C. W., C. & O. Ry., Huntington Div., Alderson, W. Va.
Walden, W. D., C. & N. W. Ry., Clinton, Ia.
Wilkinson, W. H., Erie R. R., Elmira, N. Y.
Witt, C. C., C. & N. W. Ry., Chicago, Ill.
Wise, E. F., Ill. Central Ry., Waterloo, Ia.
Zook, D. C., Penn. Lines West of Pittsburg, Ft. Wayne, Ind.

The following applicants for membership, subsequently elected, were also present:

Bailey, S. D., Mich. Cent. R. R., Detroit, Mich.
Beal, F. D., So. Pac. Co., West Oakland, Cal.
Brown, E. DuBois, L. V. R. R., New York City.
Browne, J. S., N. Y., N. H. & H. R. R., Providence, R. I.
Corrigan, C. S., G. H. & S. A. Ry., San Antonio, Texas.
Finley, W. H., C. & N. W. Ry., Chicago, Ill.
Geary, Sylvester, Penn. R. R., Cambridge, Ohio.
Graham, Wm., B. & O. R. R., Baltimore, Md.
Hall, Charles, M. C. R. R., St. Thomas, Ontario.
Hudson, B. M., St. L., K. C. & C. Ry., Union, Mo.
Hunciker, John, C. & N. W. Ry., Chicago, Ill.
Hurst, Walter, C. B. & Q. Ry., St. Joseph, Mo.
Keefe, D. A., L. V. R. R., Athens, Pa.
Keen, W. H., N. Y., N. H. & H. R. R., Hartford, Conn.
Lacy, J. D., G. T. Ry., Durand, Mich.
Layfield, E. N., Chicago Ter. Transf. R. R., Chicago, Ill.
Mann, J. M., F. W. & D. C. Ry., Fort Worth, Texas.
Neff, J. L., Union Pac. Ry., Omaha, Neb.
Nickerson, R. A., C. & N. W. Ry., Chicago, Ill.
Perry, W. W., P. & R. Ry., Williamsport, Pa.
Porter, L. H., N. Y., N. H. & H. R. R., Franklin, Mass.
Richey, C. W., Penn. R. R., Allegheny, Pa.
Robinson, J. S., C. & N. W. Ry., Chicago, Ill.
Schultz, W. T., B. & O. R. R., Zanesville, Ohio.
Wells, J. M., A., T. & S. F. Ry., Chillicothe, Ill.
Winter, A. E., C. & N. W. Ry., Chicago, Ill.
Wright, G. A., C. & E. I. R. R., Danville, Ill.

President.—When the secretary read the name of Mr. Walter G. Berg I thought of the reason that Mr. Berg is not here. They have a new chief engineer on the Lehigh Valley Road and he is so young that Mr. Berg had to stay home and take care of him. The young man, I believe, is only a week or so old, and I know we all hope that he will live to be as able a man as his father. At the first session when we call the roll we never get the names of all the members because some come in later, and for this reason cards have been prepared which have been placed near the entrance, and we would ask that all the members fill out

these white cards, giving your name, title and address, and if there are any members of your family or any of your relatives with you, kindly mark the card "Over," and on the back give the names of these parties, and when you have these white cards filled out, please hand them to the assistant secretary. For the visitors and supply men we also have a pink card, and we would also like to have them fill out cards and hand them to the assistant secretary. The next in order on the programme is the report of the Committee on Applications for Membership. Mr. Pickering is chairman on this committee, but he is not present, and Mr. J. H. Markley will read the report.

REPORT OF COMMITTEE ON APPLICATIONS.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

It is with no little pride and with very great pleasure that we present to you this thirteenth annual report of the Committee on Applications for Membership. Realizing the present high standard of the membership of this Association, we have been very careful to investigate as far as possible the character and standing of the applicants for membership, and we believe them to be all worthy and well qualified and men who will become useful and honorable members of this Association. We are pleased to present for your action in the following list, names of men not only from all sections of the North American continent, but through the kind efforts of Mr. Charles Earnshaw we are able to present the names of seven men as applicants for membership from far-off New Zealand and Australia. We welcome this as a bright star of promise for the future success and prosperity of this Association, and as the early dawn of the day when our proceedings shall be recognized as the standard of the best practice in all bridge and building questions for the entire world. The following list is, we believe, the largest ever presented at the opening of a Convention and every application being accompanied by the required fee shows the good faith of the applicants. We therefore heartily recommend the election of every man whose name appears in this list as a member of this Association.

List of applicants for membership in the Association of Railway Superintendents of Bridges and Buildings.

R. Angst, Chief Engineer, Duluth & Iron Range Railway, Duluth, Minn.

H. W. Bassett, Supt. B. & B. Pacific Coast Co., Seattle, Wash.

John C. Beye, Resident Engineer, Union Pacific Railway, corner 12 and Liberty Sts., Kansas City, Mo.

McClellan Bishop, Master Carpenter, C., R. I. & P. Ry., Chickasha, I. T.

Cyril Holm Biss, District Engineer Government Railways, Auckland, New Zealand.

Alex C. Blake, Master Carpenter, Wabash Railway, Moberly, Mo.

Austin Lord Bowman, Consulting Engineer and Bridge Engineer, C. R. R. of N. J., 29 Broadway, New York City.

J. S. Browne, Division Engineer, N. Y., N. H. & H. R. R., Providence, R. I.

Edward D. B. Brown, Architect L. V. Ry., 143 Liberty St., New York City.

James Burnett, Inspecting Engineer Government Railways, Wellington, New Zealand.

W. B. Causey, Engineer Maint. of Way, Chicago & Alton Railway, Bloomington, Ill.

S. F. Clapp, General Foreman B. & B. G. C. and S. F. Ry., Temple, Texas.

C. S. Corrigan, Resident Engineer, G. H. & S. A. Railway, San Antonio, Texas.

E. R. Floren, Master Carpenter, C., R. I. & P. Railway, Fairbury, Neb.

Thomas Hall, Supervisor Buildings, M. C. Railway, St. Thomas, Ont.

James Hartley, Supervisor Northern Pacific Railway, Staples, Minn.

N. F. Helmers, Bridge Inspector, Northern Pacific Railway, Staples, Minn.

Victor K. Hendricks, Assistant to Engineer of Maintenance of Way, Baltimore & Ohio Railway, Baltimore, Md.

Herman K. Higgins, Assistant Engineer, New York, New Haven & Hartford Railroad, 28 Dix St., Dorchester, Mass.

Walter Hurst, Superintendent Bridges and Buildings, K., C., S. & J., and C. B. Railway, St. Joseph, Mo.

David A. Keefe, Inspector Shops, Lehigh Valley Railroad, Athens, Pa.

William H. Keen, Bridge Supervisor, New York, New Haven & Hartford Railway, Hartford, Conn.

E. N. Layfield, Principal Assistant Engineer, Chicago Terminal Transfer Railway, 353 Grand Central Station, Chicago, Ill.

A. McDonald, Superintendent Bridges and Buildings, Texas & Northern Ohio Railway, Houston, Texas.

W. J. Mellor, Superintendent Bridges and Buildings, M. L. & T. Ry., and S. S. Co., Algiers, La.

Geo. C. Millett, Engineer Maintenance of Way, El Paso, Northeastern Railway, Alamogordo, N. M.

T. H. MORGAN, General Foreman, Bridges and Buildings and Water Supply, G. C. & S. F. Ry., Cleburne, Tex.

C. R. MORRILL, Resident Engineer, G. H. & S. A. Ry., El Paso, Tex.

SAM MUSTAIN, General Foreman, Bridges and Buildings, Sonora Railway, Carbo, Mex.

J. L. NEFF, General Foreman, Engineer Department, Union Pacific Railway, Omaha, Neb.

J. F. PELHAM, Master Carpenter, Erie Railway, Avon, N. Y.

H. D. PERKINS, Master Carpenter, Chicago & Eastern Illinois Railway, Villa Grove, Ill.

W. W. PERRY, Master Carpenter, Philadelphia & Reading Railway, 147 Market St., Williamsport, Pa.

LEONARD H. PORTER, Supervisor of Bridges, New York, New Haven & Hartford Railway, Franklin, Mass.

A. J. ROSS, Superintendent Bridges and Buildings, G. H. & S. A. Ry., El Paso, Texas.

W. B. RUSSELL, Chief Engineer, Temiskaming & Northern Ontario Railway, North Bay, Ont.

GEO. T. SAMPSON, Division Engineer, New York, New Haven & Hartford Railway, Boston, Mass.

D. W. SHARPE, Bridge Supervisor, New York, New Haven & Hartford Railway, New London, Conn.

H. SMALL, Superintendent Bridges and Buildings, G. H. & S. A. Ry., San Antonio, Tex.

J. C. TAYLOR, Superintendent Bridges and Buildings, Northern Pacific Railway, Glendive, Mont.

C. A. THANHEISER, Resident Engineer, T. & N. O. Ry., and G. H. & N. Ry., Houston, Texas.

GEO. C. TROUP, Office Engineer, Government Railways, Wellington, New Zealand.

J. T. WEBSTER, Supervisor Bridges, Michigan Central Railway, St. Thomas, Ont.

MARINE R. WILLIAMS, General Foreman Bridges and Buildings and Water Supply, Atchison, Topeka & Santa Fe Railway, Las Vegas, N. M.

J. M. WELLS, General Foreman Bridges and Buildings and Water Supply, Atchison, Topeka & Santa Fe Railway, Chillicothe, Illinois.

EDW. J. GOVERN, Assistant Engineer Bridges and Buildings, Buffalo, Rochester & Pittsburg Railway, Rochester, N. Y.

W. T. SCHULTZ, Master Carpenter, Baltimore & Ohio Railroad, Zanesville, O.

KARL J. C. ZINCK, Division Engineer, Chicago, Rock Island & Pacific Railway, Des Moines, Ia.

J. S. BRIGHT, JR., Assistant Engineer, Sonora Railway, Guaymas, Sonora, Mex.

HENRY C. MCKEE, Bridge Inspector, Central of Georgia Railway, Savannah, Ga.

J. D. LACY, General Foreman Bridges and Buildings, Grand Trunk Railway, Durand, Mich.

EDGAR E. BALL, Assistant Engineer, Atchison, Topeka & Santa Fe Railway (Coast Lines), Williams, Ariz.

RALPH J. ABEY, Assistant Engineer, Atchison, Topeka & Santa Fe Railway (Coast Lines), Williams, Ariz.

ARTHUR WILLIAMS, Foreman of Works, Wellington and Manawata Railway, Wellington, New Zealand.

E. S. HUME, Chief Mechanical Engineer, Western Australia Government Railways, Fremantle, Western Australia.

W. J. GEORGE, Commissioner of Railways, Western Australia Government Railways, Perth, Western Australia.

JAMES FRASER, Engineer in Chief, New South Wales Government Railways, Sydney, New South Wales.

C. F. KING, Foreman Bridges and Buildings, Chicago & North Western Railway, Norfolk, Neb.

W. J. TOWNE, Division Engineer, Chicago & North Western Railway, Chicago, Ill.

S. D. BAILEY, Division Foreman Buildings, Michigan Central Railway, Detroit, Mich.

D. ROUNSEVILLE, Division Engineer, Chicago & North Western Railway, Kaukauna, Wis.

W. H. FINLEY, Principal Assistant Engineer, Chicago & North Western Railway, Chicago, Ill.

J. S. ROBINSON, Division Engineer, Chicago & North Western Railway, Chicago, Ill.

A. E. WINTER, Assistant Engineer, Chicago & North Western Railway, Chicago, Ill.

R. A. NICKERSON, Fire Inspector, Chicago & North Western Railway, Chicago, Ill.

JOHN HUNCIKER, Foreman Bridge Erection, Chicago & North Western Railway, Chicago, Ill.

THOS. HUMPHREYS, Assistant Engineer, Southern Pacific Co., Bakersfield, Cal.

GEO. W. REAR, Assistant General Bridge Inspector, Southern Pacific Co., San Francisco, Cal.

C. W. RICHEY, Master Carpenter, Western Pennsylvania Division, Pennsylvania Railroad, Allegheny, Pa.

WM. GRAHAM, Assistant Engineer Bridges and Buildings, Baltimore & Ohio Railway, Baltimore, Md.

J. PARKS, Superintendent Bridges and Buildings, Union Pacific Railroad, Denver, Col.

P. B. MOTLEY, Assistant Engineer, Canadian Pacific Railway, Montreal, Canada.

B. M. HUDSON, Master Carpenter, St. L., K. C., & C. Ry., Union, Mo.

C. H. CARTLIDGE, Bridge Engineer, Chicago, Burlington & Quincy Railway, Chicago, Ill.

EDWIN MCCANN, General Foreman Bridges and Buildings and Water Supply, A., T. & S. F. Ry., Wellington, Kas.

F. M. CLOUGH, General Foreman Bridges and Buildings and Water Supply, Santa Fe Railway, San Marcial, N. M.

JOSEPH H. HOWE, Superintendent Bridges & Buildings, Union Pacific Railroad, Omaha, Neb.

G. A. WRIGHT, Master Carpenter, Chicago & Eastern Illinois Railroad, Danville, Ill.

J. M. MANN, General Foreman Bridges and Buildings, Fort Worth & Denver City Railway, Fort Worth, Tex.

WM. KLEEFELD, JR., Supervisor Bridges, New York Central & Hudson River Railroad, Utica, N. Y.

J. W. LANTRY, Supervisor Bridges and Buildings, New York Central & Hudson River Railroad, Weehawken, N. J.

D. L. MCKEE, General Foreman Bridges and Buildings, Pittsburg & Lake Erie Railroad, McKees Rocks, Pa.

SYLVESTER GEARY, Master Carpenter, Penn. Lines West of Pittsburg, Cambridge, Ohio.

F. H. BAINBRIDGE, Ill. Cent. R. R., Chicago, Ill.

FRANK C. STIMSON, Chicago & North Western Ry., Baraboo, Wis.

WILLARD A. PETTIS, Supervisor Buildings, New York Central & Hudson River Railroad, Rochester, N. Y.

F. O. DRAPER, Supervisor Bridges and Buildings, Illinois Central Railroad, Freeport, Ill.

F. D. BEAL, Superintendent of Wood Preserving Plant, Southern Pacific Co., West Oakland, Cal.

S. BOUTIN, Master Carpenter, St. Louis & San Francisco Railway, Cape Girardeau, Mo.

Respectfully submitted,

B. F. PICKERING,
J. H. MARKLEY,
W. E. ALEXANDER,
A. W. MERRICK,
Committee on Applications.

Mr. J. H. Cummin.—I would move that the report of the Committee on Applications be received, and that the assistant secretary be authorized to cast one vote for all these new members. While on this subject it might be as well to advise all the members that the order of applications is never closed in this Association.

President.—I think that should be printed in our proceedings. The way they are coming in shows that they appreciate a good thing when they see it. It will require the unanimous vote of all present to authorize the assistant secretary to cast one ballot for this list of new members. Are there any objections? If not, I will call on our assistant secretary to cast one vote as moved by Mr. Cummin.

Assistant Secretary.—Mr. President, the vote is so cast.

President.—I declare these applicants elected members as recommended by the committee.

President.—We are going to have a short recess now for the reception of new members and to give us a chance to get acquainted with them. I would ask before we have that recess that the ladies kindly remain for a few minutes, as the president has a short address which he is going to read, and it is customary for the ladies to remain.

Thereupon a recess was taken for the introduction of the new members, after which the meeting was again called to order, and the president delivered his annual address:

Ladies and Gentlemen, Members and Friends:

It has been the custom for the president to make an annual address outlining the progress of the Association for the past year.

Today we are convened in the progressive City of Chicago, a city, the name of which is synonymous with action and success.

A city larger than twenty-six states in the Union. The fifth city in the world, with a population greater than the combined population of the states of Idaho, Montana, Nevada, North Dakota, Delaware, Utah, Wyoming, and the territories of Arizona and New Mexico.

May we not hope that our Association at this Convention will absorb some of the push and action so emblematic of Chicago? Eight years ago when we met in this beautiful city we had a membership of one hundred and forty. Since that time our membership has doubled.

Each year the work of this Association increases in importance. The last proceedings consist of a book of over 400 pages, with about 90 illustrations.

These proceedings compare very favorably in importance and volume with those of any other railroad association in the country. While we cover only one branch of maintenance of way work, we cover that branch well.

Financially you are prosperous, as shown in the reports which will be submitted to you.

It is my earnest hope that the succeeding annual reports will show the same or greater progress. We must not be satisfied to merely hold our own. To succeed we must progress. When we are apparently standing still we are going backward.

Every man who serves on a committee derives considerable benefit from his affiliation with that committee. In pursuing the necessary investigation he gathers a useful fund of information. The same is true of a member attending the convention. Our members are willing to give to the Association earnest, faithful service. That has been the secret of our past success, and is our hope for the future.

The proceedings of the Executive Committee meetings held during the past year will soon be read, therefore it will not be necessary for me to refer to them.

At the Executive Committee meeting held at the Auditorium Hotel, Chicago, March 15th, 1904, the president was authorized to prepare and send out letters to the various railroads having no membership in this Association, inviting them to secure representation. Acting on this authority, a small booklet was prepared outlining the work of the Association. A letter and booklet was sent to the general manager of every railroad in this country and Canada not

represented in the Association and having a mileage of one hundred miles or more. The responses were very encouraging. A large number of applications were received. One general manager sent membership applications for seven division engineers and superintendents of bridges and buildings.

Letters and booklets were also sent out to superintendents of bridges and buildings, bridge engineers, etc.

The railroads certainly show their appreciation of the work being done by this Association, and want their men to secure the advantage of the committee reports and discussions.

Your Association now represents railways having a mileage of more than 157,000 miles, or more than three quarters of the total railway mileage of the United States. Over 8,000 miles of the above amount were added since the last Convention.

During the past year grim reaper Death has stricken two of our members.

J. W. Lovett, who joined the Association at Atlanta, Georgia, in 1901, died November 29, 1903, as the result of an accident while on an inspection trip with a small car. Mr. Lovett lived at Atlanta, Ga., and some of the members will doubtless remember him as having been on the Entertainment Committee when we met at Atlanta in 1901.

G. W. McGehee, a charter member of this Association, died August 9, 1904, at Okalona, Mississippi, aged fifty-two years. He left a wife and six children, two of whom are grown young men in the employ of the Mobile & Ohio Railroad. Mr. McGehee was born in Louisa county, Virginia, in 1852, and began his railroad career on the Huntington division of the Chesapeake & Ohio when it was under construction in 1873-'74. At the time of his death he was superintendent of bridges and buildings of the Mobile & Ohio Railroad. The Committee on Memoirs will present a report on the death of these men.

I think every one who has attended the Conventions of

this Association has been impressed with the fact that our members meet together to discuss the committee reports and to gain useful knowledge in the various lines of work. A little diversion is a good thing, and in this Association it does not interfere with our work. The ladies who attend the Conventions always seem to enjoy themselves, and if common report is true, look forward each year with a great deal of pleasure to the next Convention. We are certainly all pleased to have the ladies attend our Conventions. Their smiling faces encourage us in our work.

The members who took the trip on the Intercolonial Railway last year will always remember with pleasure the royal good time we had. It was a true sample of Canadian hospitality, and I hope the day will come when we can all pay another visit to our Canadian friends.

In closing I wish to thank you all for the honor conferred on me one year ago at Quebec. I hope I have merited the confidence reposed in me. I have had the cordial support of the officers and members. Our able secretary, the "Deacon," has ever been ready to help me in any way he could, and I wish to say to him now I sincerely appreciate his support. I shall always take a deep interest in the Association, and will help in my small way towards its advancement. I bespeak for my successor the same support shown me and feel assured the Association will in the future show the same progress and growth it has in the past.

President.—Before announcing a recess for the payment of dues, I will say that we have made a slight change in the programme and I think it would be well to announce our programme and any changes that may be made at several of our meetings. It seemed undesirable to take the lake trip at this time of the year. We found that it would require a very large steamer, as the small boats would not go out on the lake so late in the fall, as we are liable to have stormy weather at any time. Furthermore, our time would be used to better advantage by taking the trip to South Chicago by a special train which the Illinois Central

has very kindly tendered us, and the present intention is to leave Thursday afternoon at 1.30 p. m. at the Randolph street station of the Illinois Central. The trip to South Chicago was to be on Friday, but we have changed it to Thursday afternoon. On Friday afternoon we expect to take a trip through part of the tunnels of the Illinois Telephone company, which are under the streets of Chicago at a depth of about fifty feet, and you will also inspect the switch boards where they have no operators, and which is automatic in its action. In the afternoon we will take the trip as planned on a smaller steamer down the Chicago river and drainage canal, which will also enable us to get through the bridges better. You see we are not curtailing the programme, but broadening it. The badges for the members will be given to those who have not received badges heretofore, and we have a gold badge for the members' wives who have not received them before. I will also say that any member or his wife who left his or her badge at home will be furnished a badge, and they will kindly return them at the end of the meeting. These badges for the members and their wives are given to them, and as they are rather expensive we cannot furnish duplicates, but we will be glad to loan them one if they have forgotten their own. We also have a badge for members' families and for visitors, including the supply men. We will now take a short recess for the payment of annual dues and the distribution of badges.

Recess was then taken for this purpose.

President.—We have a few reports here which we should like to get out of the way before lunch, if possible. The ladies, of course, are excused if they want to go, but we shall be glad to have them stay if they wish. All we shall do now before lunch is to listen to the reading of two reports.

Secretary Patterson thereupon read his annual report.

REPORT OF SECRETARY.

To the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: Your secretary submits the following report for the year ending Oct. 18, 1904. After a very interesting and profitable Convention at Quebec and adjournment, the members and ladies boarded a special train of Pullman cars furnished us by the courtesy of the Intercolonial Railway and the able management of our worthy member from that road, Mr. A. E. Killam, and enjoyed a beautiful trip down the St. Lawrence River, through the Provinces to Sydney, Cape Breton, returning through St. John to Montreal, affording great pleasure to all. The Executive Committee have had careful supervision of the affairs and management of the Association, having met three times, and their instructions have been carefully carried out. The president appointed the several committees, and the president and the local committee, Mr. A. S. Markley and Mr. R. C. Sattley, presented a programme for our fourteenth Convention. On Nov. 29, 1903, Mr. J. W. Lovett died from the effects of an accident. Hs name was enrolled in the list of deceased members in our last proceedings. Also Mr. G. W. McGehee was taken from us in August, 1904. Also Mr. W. B. Mitchell's name is on the deceased members' list, information coming too late for mention in our last report. Proper memoirs will be presented by the Committee. We sympathize with their friends, and with them mourn their loss. We have now on our rolls 230 names, with 90 applications to be acted upon today, and our Association is in a prosperous condition. I wish again to thank our advertising patrons for their liberal support and friendly greetings; also to thank the members for their loyal support.

FINANCIAL.

Dr.

To cash in my hands at last report	$191.03
Cash received for dues and new members	506.00
Cash received for advertisements	1,233.40
Cash received for sale of books and tables	52.98
Total	$1,983.41

Cr.

By cash paid out, for which I hold vouchers	$1,938.62
Balance in my hands	$44.79

Respectfully submitted,

S. F. PATTERSON,
Secretary.

Motion was then made and seconded that the report be accepted as read.

The treasurer's report was then read by the treasurer, Mr. C. P. Austin.

TREASURER'S REPORT.

To the President and Members of the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: Dec. 15, 1904, I received check from the Old National Bank of Fort Wayne, Indiana, for $582.13, being the amount left by my predecessor, N. W. Thompson.

Dec. 19, 1903, deposited in the Medford Savings Bank Medford, Mass.	$582.00
May 4, 1904, three months' interest	5.82
Oct. 12, 1904, received from secretary	50.00
Oct. 12, 1904, cash in bank	$637.82
Oct. 12, 1904, cash in hands of treasurer	.13
Total	$637.95

Respectfully submitted,

C. P. AUSTIN,
Treasurer.

Upon motion made and seconded, the report was accepted as read, and the secretary's and treasurer's reports were referred to the Auditing Committee.

The annual report of the Executive Committee was then read by the secretary.

REPORT OF THE EXECUTIVE COMMITTEE.

CHICAGO, ILL., Oct. 18, 1904.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: Your secretary submits the following report for the past year. The Executive Committee have held three sessions during the year with good attendance. The usual routine business was transacted and the welfare of the Association well looked after. The matter of transportation for our members was discussed and Mr. W. G. Berg was appointed a committee to confer with the Trunk Line Association at their next regular meeting, and try to secure transportation for our members to our Conventions. Voted to reimburse Mr. Berg for any expenses he may have incurred in attending to that duty. Good results have resulted from the effort. Mr. J. H. Cummin was appointed a committee to procure badges for our next Convention. The president was instructed to appoint a local committee to make arrangements for our next Convention in Chicago. The president outlined a plan to send out circulars in view of increasing our mem-

bership, and after discussion he was instructed to carry out his plan. After discussion it was voted to leave the details for our next Convention, transportation, etc., to the president and local committee. The president was requested to endeavor to obtain for presentation at our next Convention special papers on some subjects connected with the bridge and building work. On motion it was voted to adjourn.

S. F. Patterson,
Secretary.

Upon motion made and seconded, the report was accepted as read.

President.—Next follows the appointment of the necessary committees, and I will now announce the following:

NOMINATING COMMITTEE.

J. H. Cummin, M. Riney, W. M. Noon.

AUDITING COMMITTEE.

W. O. Eggleston, C. C. Witt, F. E. Schall, W. E. Harwig.

OBITUARY COMMITTEE.

W. E. Alexander, H. Rettinghouse, A. H. King.

COMMITTEE ON RESOLUTIONS.

R. H. Reid, J. P. Canty, R. C. Sattley.

ENTERTAINMENT COMMITTEE.

A. S. Markley, R. C. Sattley, J. H. Cummin.

The report of the Obituary Committee was then read by the assistant secretary.

REPORT OF OBITUARY COMMITTEE.

As it has been the will of God to take from our numbers two of the faithful members of our Association, and thus remind us of the uncertainty of life and of the importance of being prepared for death, therefore be it

Resolved, That we as an Association sincerely mourn the loss of these beloved brothers, J. W. Lovett and G. W. McGehee.

Resolved, That the sympathy of this Association be tendered to the widows and families of these deceased brothers by the secretary, and that a copy of these resolutions be printed in full in our proceedings.

W. E. Alexander,
A. H. King,
H. Rettinghouse,
Committee.

Motion made to receive the report seconded and carried.

REPORT OF COMMITTEE ON MEMOIRS.

Your committee on memoirs presents herewith memoirs of our deceased members, as follows: W. B. Mitchell, who died October 31, 1902; J. W. Lovett, who died November 29, 1903, and G. W. McGehee, who died August 9, 1904.

WALTER G. BERG,
Committee.

October 10, 1904.

MEMOIR.

W. B. MITCHELL.

ELECTED MEMBER . . . . October 16, 1894.
DIED . . . . October 31, 1902.

W. B. Mitchell was master carpenter of the Cincinnati Division of the New York, Pennsylvania & Ohio Railroad of the Erie Railroad system, Galion, O.

He was struck by a train on October 31, 1902, while directing work on a bridge at Akron, O., and instantly killed.

Mr. Mitchell was born on September 18, 1838, in Jefferson county, Ohio. His early life was spent on a farm and in a mill his father owned. In 1862 he enlisted in the Union Army and served his country until the close of the war in 1865.

He commenced railroad work in 1871 in the bridge department of the old A. & G. W. R. R., now a part of the Erie Railroad system. He continued with the Erie Railroad until the time of his death. He was appointed master carpenter of the Cincinnati Division in 1889. He enjoyed the confidence and good will of all his superior officers, was an efficient bridge supervisor and was well liked by all his men.

Mr. Mitchell joined the Association on October 16, 1894. He attended the Convention at Richmond, Va., in 1898.

MEMOIR.

J. W. LOVETT.

ELECTED MEMBER . . . . . . October 15, 1901.
DIED . . . . November 29, 1903.

J. W. Lovett was supervisor of bridges of the Southern Railway at Atlanta, Ga.

On November 25, 1903, he was making an inspection trip on a handcar and was met by a freight train on a curve in a cut. He and the other men with him leaped from the car in safety but he stepped back to get a valise from the car and was struck by the engine. He was immediately taken aboard and carried to a hospital in Chattanooga, where he died on November 29, 1903.

Mr. Lovett was born in Warren county, Ga., December 25, 1852, and later removed to Lawrence county, where he attended the public schools. He began his railroad career with the East Tennessee, Virginia & Georgia Railroad, now a part of the Southern Railway, on April 17, 1883, as a carpenter, and in a short time was promoted to the position of foreman, and in 1887 to that of supervisor. He had worked for the road continuously as foreman and supervisor of bridges and buildings from that date until his death, with the exception of a short interval when he

was engaged in building bridges and buildings for a new line in Florida.

Mr. Lovett joined the Association at the Atlanta Convention on October 15, 1901, and served on the entertainment committee for that meeting, as also on several business committees. He was also present at the Minneapolis Convention in 1902.

MEMOIR.

G. W. McGehee.

Charter Member	September 25, 1891.
Executive Member	1891-1892.
Died	August 9, 1904.

G. W. McGehee was superintendent of bridges and buildings of the Mobile & Ohio Railroad at Okolona, Miss.

He died at his home in Okolona, after a short illness, on August 9, 1904. He had acute liver trouble and was in bad health for several months before he died, although he did not stop work until ten days before his death. He left a wife and six children. Two of the boys are grown and working for the M. & O. R. R. Mr. McGehee owned a nice house at Okolona and left his family well provided for.

Mr. McGehee was born in Louisa county, Va., in 1852, and began his railroad career on the Huntington Division of the Chesapeake & Ohio Railroad when it was under construction in 1873 and 1874, and was connected with the bridge department of that system from 1874 to 1882, when he went to the Brunswick and Atlanta Division of the E. T. V. & G. R. R. (now the Southern) as superintendent of bridges and buildings. In 1886 he entered the employ of the Mobile & Ohio Railroad as superintendent of bridges and buildings, which position he held continuously for 18 years until his death.

Mr. McGehee was a charter member of the Association, having been present at the preliminary organization meeting and first annual Convention held at St. Louis on September 25, 1891. He also attended the Convention at St. Louis in 1900, at Atlanta in 1901 and at Minneapolis in 1902. He was a member of the committee on constitution and by-laws, appointed at the preliminary organization meeting of the Association in 1891, and also served on the committee on frame and pile trestles in 1891-1902. He was a member of the executive committee for 1891-'92.

The report of the Committee on Relief was then read by the assistant secretary.

REPORT OF COMMITTEE ON RELIEF.

Sherman House, Chicago, Ill., Oct. 18, 1904.

To the Officers and Members of the Association of Superintendents of Bridges and Buildings, Greeting:

Your Committee on Relief which was appointed at the last annual meeting which was held at Quebec, Can., are happy to

inform you that there have been very few applications for relief, and all that did apply were given prompt attention.

Your committee submits the following form of relief application which was gotten up by one of our members, Mr. M. Riney, and would respectfully ask that it be adopted by the Association. Copy of form attached.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.

RELIEF.

——————— 190—.

Mr. ————————

DEAR SIR:

Mr. ————, formerly with the ———— R. R. Co., is out of employment. Kindly fill out blank below, advising if you can furnish him with employment, or know of any opening that he might be able to secure, and return. He has had —— years' experience as Sub-Division foreman, and —— years as Supt. B. & B.

Yours truly,

————————,

————————,

Committee.

Mr. ————————,

Chairman of Relief Committee.

I can furnish Mr. ———— with employment in capacity of

————————————————————

Yours truly,

————————.

Respectfully submitted,

JAMES STANNARD,
M. RINEY,
MOSES BURPEE,
E. B. ASHBY,
JOHN D. ISAACS,
W. M. NOON,
Committee.

Motion made to receive the report seconded and carried.

President.—We have on hand a few of the booklets giving an outline of the work we are doing, and any one who is interested can call at the desk for one of them. I would also say that the supply men here have gone to considerable expense to show their goods, and we ought as much as possible to inspect them and see what they have to offer. I have a letter here from Mr. J. W. Taylor, a photographer, who is very anxious to take a picture of the members and their wives. It is going to be hard to arrange to have all

the members present at any one time for this picture, and perhaps it would be best to have this picture taken on Friday afternoon, as we start on our boat trip down the river. If it is not convenient to take the picture at the dock, perhaps the members could arrange themselves on a bridge somewhere on the river. The assistant secretary has a number of letters which he wishes to read of various announcements that have been sent in in regard to visiting various places of interest, and a reception to the ladies by Mrs. Johnson. He will also read letters of regret at not being able to be present from W. G. Berg, James Stannard, F. S. Edinger, R. P. Mills, J. S. Berry, E. Fisher, J. D. Gilbert, Floyd Ingram, G. Larson, J. D. Isaacs, P. N. Watson, D. A. Shope, J. S. Lemond, and B. F. Pickering.

President.—I have a letter from the general superintendent of the South Works of the Illinois Steel Company stating that he has arranged for the necessary guides to show the members of our Association through their plant. The special train will leave Randolph street at 1.30 p. m. sharp, and we will stay at the plant some three hours or more Thursday afternoon. The Entertainment Committee has arranged for the care of twenty-five persons at Mrs. Frances Kneerins', No. 4744 Olive street, St. Louis. We have a letter from Mr. Stannard saying that the Christian Endeavor Hotel, managed by Mr. C. G. Baird, will take care of a large number of the members. We will wire Mr. Baird the probable number of persons we will wish him to take care of as soon as we can ascertain that information from the members. There is an entrance to the fair grounds within 100 feet of this hotel.

Motion was seconded and carried that adjournment be taken until 2 o'clock.

AFTERNOON SESSION, TUESDAY, OCTOBER 18, 1904.

President.—Please come to order, gentlemen. We will now take up the subjects that we had last year for further

discussion, as usual. The first subject carried over from last year was "Best false work for rocky bottom in rapid currents where piles cannot be driven." Is there anything further that the members can offer in relation to that subject? We had a pretty complete report last year and a good discussion.

Mr. Steffens.—In view of the excellent report submitted by the committee last year and the infrequent necessity for such work, I move that the subject be passed and that we proceed to the next subject.

Subject was passed with no discussion.

Assistant Secretary.—I have some announcement cards here which I have been passing out to the ladies as I met them in the halls, but the chances are that I have missed some of them, so I would like to read this announcement: Mrs. Frank J. Johnson will be at home to the ladies of the Association October 19th, from 2.00 to 5.00 o'clock at No. 6550 Harvard avenue. Provision will be made for carrying them from here and returning them to the hotel, and we ought to know how many will go, as they will go out in automobiles or carriages.

President.—The next subject carried over from last year was subject number two: "Should ties of bridges be gained so as to leave rail without camber, or should only a portion of the camber be taken out?" (See discussion.)

The remaining subjects carried over from last year were then brought up and passed without further discussion, as follows:

3. In case one arm of an important metal drawbridge over a deep stream should be wrecked, what is the most expeditious way to restore railway and water traffic?

4. Best method of protecting solid steel floors of bridges.

5. Best plans for small tool houses, including switchmen's and car repairers' shanties, and section, tool and hand-car houses.

6. Best practical sanitary arrangement for small stations where there are no water or sewer systems.

7. Best method of making annual inspection of bridges and culverts, and form of report to be made.

8. Water filters, or other methods of purifying water for engine use.

9. Best method of storing fuel oil with appliances for supplying locomotives, including plan of water stations, showing relative arrangements of fuel and water supply.

President.—I think we are ready now to take up our regular committee reports. The first subject is, "What is the best form of traveler to use in erecting steel railway bridges up to 200 feet?" This is one of the most important subjects that we have, and it is too bad that the report is not in printed form. Mr. G. W. Smith, the chairman of this committee, is not present, but it would be better to discuss this subject now rather than to postpone it until later. I would therefore like to have the members talk as fully on this subject as possible, so that we can get out a lot of good points, and I would ask the new members in getting up to give their names.

Report on subject number one was then read by the assistant secretary. (See report on subject number one.)

President.—The next subject for report and discussion this year is number two, "What has been the experience in the use of concrete under bridge bed-plates and turn-tables in place of pedestal stones, and what is the best form and material for bed-plates under various styles of iron bridges?" No report has been made, but I suppose that this will come in later. This subject has been carried over at three different conventions, and if we do not get a report on it this year, I think we had better drop it.

Mr. Reid.—Would it not be well to call for the discussion on this now and let the report come in later? It seems to me that the use of concrete is a growing question. (See discussion.)

President.—The next subject is number three, "Best method of caring for trestles while being filled." (See report on number three.)

President.—This subject is certainly a very interesting one, and I think there will be something more to say about it, but if we are going to have an evening session, perhaps it would be better to bring it up again then.

Adjournment was then taken until 8 o'clock p. m.

EVENING SESSION, TUESDAY, OCTOBER 18, 1904.

President.—Gentlemen, when we adjourned this afternoon we were discussing subject number three, "Best methods of caring for trestles while being filled." Is there any further discussion on this?

(See further discussion.)

President.—The next subject is number four, "Best forms of construction for engine houses." As some of the members wish to talk on this who cannot be here tonight, we will pass to subject number five, "Best methods of filling ice-houses and conveying ice to refrigerator cars."

Mr. Carpenter.—I beg to ask a little further time. We have been unable to formulate our report as yet, but we hope to be able to do so tomorrow.

President.—We will then pass it and bring up subjects numbers four and five tomorrow. The next subject is number six, "Best methods of filling track water tanks automatically. Mr. Ashby is the chairman,

Mr. Schall.—Mr. Ashby spoke to me about this and said he had tried to get the information together, but had not succeeded. He will be able to get up something by tomorrow, however.

President.—We will then pass to subject number seven, "Steam hammers versus drop hammers for pile drivers."

(See report.)

President.—For those who wish to know when Mr. Finley's paper will be read, I will state that it will probably be Thursday forenoon. I should like to find out how many of the ladies are going to make the trip to South Chicago Thursday afternoon at 1.30 o'clock. Some think that the

ladies would not care to go down to the mills and wander around through the dirt and dust. It is poor walking, I will admit, and will cut your shoes some. There will probably be some entertainment provided for those who remain here, so they will not be lonesome.

On motion adjournment was then taken until 9 a. m. Wednesday morning.

MORNING SESSION, WEDNESDAY, OCTOBER 19, 1904.

President.—Gentlemen, the time is past due for us to come to order. We will first listen to the report of the Auditing Committee.

The report of the Auditing Committee was then read by Mr. Schall.

REPORT OF AUDITING COMMITTEE.

CHICAGO, ILL., Oct. 19, 1904.

Mr. President, Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

The undersigned Committee on Auditing beg leave to offer the following: We have examined the accounts of our secretary, Mr. S. F. Patterson, and of our treasurer, Mr. C. P. Austin, and find the following:

Secretary's report:	
Cash on hand last report	$191.03
Received during year for dues and membership fees	506.00
Received for sales of books and tables	52.98
Received for advertising	1,233.40
Total	$1,983.41
Disbursement:	
Expenses as per vouchers	$1,938.62
Balance in hands of secretary, Oct. 19, 1904	$44.79
Balance in hands of treasurer same date	637.95
Cash balance on hand	$682.74

Secretary has in his possession a bond of $500 for the treasurer.

Respectfully submitted,

W. O. EGGLESTON,
F. E. SCHALL,
C. C. WITT,
W. E. HARWIG,
Auditing Committee.

President.—This report does not, of course, include the fees received from the new members nor the fees received yesterday, and you will see that the Association is in a very flourishing condition. If there are no objections this report will be received and placed in our minutes.

Motion made to receive the report was seconded and carried.

President.—Those who have not secured their return sleeping car passes can do so by going to the Pullman Company's office in room 415 of the La Salle Street station. By showing your credentials, your badge or receipt for dues, and the receipt for the sleeping care fare that you paid coming, you can get a pass returning. Last night when we adjourned we were discussing the subject of "Steam hammers versus drop hammers." If there is nothing further on that we will pass to subject No. 8, "Best form of construction for docks and wharves."

Mr. McGonagle.—Mr. Isaacs, the chairman of this committee, has not communicated with any one on the committee to my knowledge and he is not here at this Convention, but as the subject is a very important one I hope that it will be continued and the chairman urged to prepare a proper report. It is one of the most interesting subjects, I think, that we have ever had presented to this Association, and during the next year I will be in position to assist the chairman in the preparation of this report.

President.—As Mr. McGonagle is chairman on next year's committee on subjects for report and discussion, it will come within his province to include this subject.

Mr. McGonagle.—At this time I should like to say that the committee on subjects for next year would be pleased to receive communications from all the members giving their ideas in this respect. We are simply a committee and do not care to make the subjects ourselves. You are all interested in the naming of subjects as well as in their proper discussion.

President.—We will have to pass subject No. 8, which will

probably be carried over until next year. The next subject is No. 9, "Best record forms for buildings, water tanks, etc." (See report.)

President.—The next subject is No. 10, "Best freight and roundhouse doors and fittings for same." Mr. Banks, the chairman of this committee, is not present, but the report has been printed and I do not think it will be necessary to read it. (See report.)

President.—The next subject to be discussed is No. 11, "Best methods for preserving timber and piles in structures." Mr. Steffens is chairman of that committee and has made a report which I do not think it will be necessary to read. (See report.)

President.—The next subject is No. 12, "Best method of protecting low overhead structures over tracks from gases and blasts of locomotives." Mr. Guppy, the chairman of this committee, was taken sick and Mr. Aldrich has made a report. I will ask Mr. Aldrich if he has anything further to offer. (See report.)

Upon motion adjournment was then taken until 2 p. m.

AFTERNOON SESSION, WEDNESDAY, OCTOBER 19, 1904.

President.—Gentlemen, please come to order. I have here a letter from Mr. James Stannard. He states that he is exceedingly sorry not to be present. This is the first meeting that he has not attended since the organization of our Association. He hopes to have the pleasure of meeting the members at the St. Louis Fair. We will now listen to the report of the nominating committee.

Report was then read by Mr. J. H. Cummin.

Mr. President and Members of the Association of Railway Superintendents of Bridges and Buildings.

The nominating committee beg leave to submit for your consideration the following names:

President.—C. A. Lichty.

First Vice-President.—J. B. Sheldon.

Second Vice-President.—J. H. Markley.
Third Vice-President.—R. H. Reid.
Fourth Vice-President.—R. C. Sattley.
Secretary.—S. F. Patterson.
Treasurer.—C. P. Austin.
Executive members.—W. O. Eggleston, A. E. Killam, H. Rettinghouse, J. S. Lemond, W. H. Finley, C. W. Richey.

J. H. CUMMIN,
M. RINEY,
W. M. NOON,
Committee.

President.—Of course you all understand that this will not prevent any one from making additional nominations at the time of the election. If there are no objections we will receive the report until the time comes up for action. In the meantime, remember that any one can be nominated and that every one can have a chance to vote as he wishes.

In the morning session we were still discussing subject No. 12, "Best methods of protecting low overhead structures over tracks from gases and blasts of locomotives." Are there any further remarks on that subject? If not, we will begin with No. 4, which was carried over from our session yesterday afternoon, "Best forms of construction for engine houses." (See report.)

President.—We have had a discussion on subject No. 2, "What has been the experience in the use of concrete under bridge bed-plates and turn-tables in place of pedestal stones, and what is the best form and material for bed-plates under various styles of iron bridges?" We discussed the matter because it had been up before four conventions and we wanted to get it in. We now have a report from that committee. Perhaps it would be well to have it read.

Report was read by assistant secretary. (See report.)

President.—The next subject for discussion is No. 5, "Best methods of filling ice-houses and conveying ice to refrigerator cars." (See report.)

Letter was then read by the assistant secretary from the Western Society of Engineers, extending the use of their

clubrooms and inviting the members to a "Smoker" to be held Wednesday evening, October 19.

President.—We should be glad to accept the kind invitation of the Society of Western Engineers, but we are going to have a little entertainment here this evening. Any one who does not care to stay, however, can go down there and meet some of his friends. Mr. Nichols states that the Illinois Central has arranged to run the special train to the Steel Works, leaving Randolph Street station at 8 a. m., Friday morning. This has been changed from the previous afternoon, as the Illinois Telephone Company could best take us through their tunnels Thursday afternoon. The next subject for discussion is No. 6, "Best methods of filling track water tanks automatically." (See report.)

A paper, entitled "Cleanliness of Station Grounds and Buildings," was then read by Mr. J. H. Markley.

GENTLEMEN.—Before beginning such an important subject I must apologize for so brief a paper on a matter that should be discussed thoroughly. For the want of time and because of unexpected business matters I admit that I have not had time to do the subject justice.

The only remedy I can offer is to keep the subject open and dwell on these lines continually until we have cleanliness standing out prominently.

You will notice that at times I have strayed away from the subject of this paper. I do this in order to give my hearers my idea as to how cleanliness, ornamenting and beautifying can be done at a very nominal expense. A little later I will refer to some personal experiences. I do so for one reason, that is, to give my co-workers the full benefit of my experience and not for a personal meaning.

Cleanliness, like so many other neglected necessities, can be had only when the heads of the various departments insist upon it. The great trouble among the various departments of our great railroads is that one department is jealous of another and is afraid to do something out of its line lest it be credited to that of another department. Why not teach employees to interest themselves in the company's welfare as they would do in their own personal affairs.

Have you ever asked one of your men, who is inclined to be always a little late and a little neglectful and lazy, if he expects to earn more than just what the company pays him. What is the answer? Nine out of every ten will say, "I am to earn just what the company pays me and no more."

Here is an opportunity for you to teach such men a great lesson, that is, if it is done in the proper spirit and when both are in the right temper. In nearly all cases the man gives the answer without giving a thought to the meaning. If he is the right kind of a man he will soon realize that his employer must have profits from his labor.

I have found another way to test such men as to their personal interest in the welfare of their employer and that is to send them on a mission of some responsibility, to make some minor repairs and, as is often the case, on account of the train service, there is more or less dead time. You will find that he has done all that you told him except that portion that "I forgot." On investigating you will find the debris scattered all around the place where he did the work or, as I have often seen in repairing platforms, he would throw the old lumber under the platform rather than spend the balance of his time in cleaning up. This is only one of the many cases that come up during the year, where waste time can be utilized on the lines of cleanliness and it will cost nothing. Most all of us have large lumber yards and shops where there are no regular men to do the loading and unloading and it is all handled by various crews of men, who take no interest in the appearance of the yard. They load what they want and throw down what they do not want in order to get through as soon as possible, instead of using their dead time in cleaning up.

It takes time to teach men in cases of this kind to put their time in cleaning up and doing whatever is to the interest of the company.

Referring further as to how we can accomplish cleanliness and beautify with no extra labor I would say that we must have patience, as we cannot bring about a complete system and a complete clean up at every station in one year. Neither can we bring about the same results at every station at any time.

I will relate a personal experience with an old army and pump veteran, with whom I have passed many a pleasant hour. I knew he was very fond of flowers, so I asked him if he would put out a flower bed if I would inclose a small space with a neat iron railing. He clapped his hands and said, "Certainly, Mr. Markley, I would be glad to do it and my wife will help, as she takes great interest in working among flowers." I was not long in getting the railing up and he was equally as prompt with his portion of the work. While we cannot expect such free and willing actions from all of our pumpers, as they have not the gift of a florist or a landscape gardener, yet there is this one thing that they all can do and that is keep the surroundings neat and clean, and, though the flowers are absent, you can have a good stand of blue grass and by keeping it well trimmed it adds to the appearance and the cost is very small in comparison with the improvement. The inexperienced one may have vines and shrubbery, for this ornamentation any one can make. The first year or two he may not train his decorations very artistically, but experience and perseverance will soon master the art.

It costs very little to do this and the same spirit can be taught to the flagman, the bridge watchman and all such employees who are required to be at their post of duty and at the same time have

a great deal of spare time each day that can be devoted to the purpose of cleanliness and beautifying their surroundings.

Have you ever noticed in your travels the use the right of way is put to in the way of a dumping ground that makes it look like the backyard of all nations. Does it cost anything to stop such a filthy practice and credit it to cleanliness?

I have still more suggestions to make that will add very much to the subject of cleanliness without cost and that is to insist on station employees, instead of opening the back windows and throwing the ashes out, to carry them a reasonable distance away or, better still, provide them with a box so that they can be put out of sight. In the last five or six years I have made it a practice to send stove polishing outfits over the road and find that the men are willing to do this work and it adds to the appearance and is a credit to cleanliness.

In order to encourage the agent and others along the lines of cleanliness there are some very good conveniences that should be provided in our depots and these are the file cases for stationery and supplies. In this way they may be kept out of sight and dust. In planning depots it is as easy to put these in as it is to plan a wardrobe or closets in your homes.

What will greatly encourage this work has been taught me by keeping up the small repairs as well as the larger ones or, in other words, take the stitch in time. By doing this you will encourage the station and other employees to do their part.

Another suggestion may be offered. It may not be our duty to assist in cleaning up but I claim it is our duty to lend assistance in this way, to encourage our men in their work. When you are making an inspection and a local trip over various divisions, stop long enough to inspect the clean places, the flowers and ornamental beds, especially those that have been made by the free and willing hand. By doing this it will create an impression upon the maker that his work is appreciated and he will try the harder to beautify his section.

In this hurry-scurry world of ours we are making some grave mistakes. We are running over the details. If we wish to succeed in any business we must grasp the opportunity that is open to one and all and I am sorry to say it is embraced by few, that is, we fail to observe details and trample down the small things and in time neglect the larger and more important duties.

In reaching the closing point I feel that I have barely touched on this important subject and that there has been only a little said along the lines of cleanliness and there is plenty of room to say and do more. I feel, though, that I have said something that at least will furnish food for thought, and I thank you one and all for your kind attention.

The following cities were then nominated as places for holding the next convention, viz.: Pittsburg, Cleveland and Niagara Falls, and ballot taken.

President.—Gentlemen, this is the result of your ballot: Niagara Falls, 9; Cleveland, 5; Pittsburg, 46. You have

therefore decided on Pittsburg as the place for holding our next Convention by a very large majority vote.

Upon motion, adjournment was then taken until 9.30 Thursday morning.

MORNING SESSION, THURSDAY, OCTOBER 20, 1904.

President.—Gentlemen, please come to order.

Mr. McGonagle.—I would like to make a suggestion which I have discussed with a number of the members this morning. While we are getting our subjects into shape for next year, would it not be wise for this Association to establish standing committees on the principal lines of our investigation; for instance, Pile and Framed Trestle Bridges, also the subject of Steel Bridges and Water Supply. By adopting this form of a committee they could bring facts up to date from year to year and could add supplementary pages to our proceedings and keep the subject up to date, rather than to have them as promiscuous subjects and discuss them from time to time. I would like to have an expression from the Association as to whether they do or do not approve of this idea. It would help your committee materially in selecting subjects for next year.

Mr. Shane.—In regard to the suggestion of Mr. McGonagle, I think that while a permanent committee would give the members of that body an opportunity to inform themselves on that subject and a better opportunity to gather it, yet I feel that in many instances the presiding officer would find it expedient to make changes and, if such a plan should be adopted, it should be in such a manner that the president could exercise his authority.

Mr. Schall.—I am sure that Mr. McGonagle does not mean that the same men would serve on the same committee all the time. The personnel of the committee can be changed from time to time.

Mr. McGonagle.—That is my idea. It would not be

necessary to have the same members all the time and the members would, I think, take interest enough to furnish the standing committee with all the latest information. Our particular field is the maintenance of bridges, but I can see that our Association will gradually get to the point that is held by other associations of creating standards as far as possible and we will come to the idea where we can recommend a standard cattle-guard for instance, or a standard design for a pile or steel bridge or approved methods of construction and maintenance. In that manner we will be giving to the various roads our best ideas, and by compiling the various ideas of the different members I think we can arrive at information that will be of value. At the present time our investigations cover a wide field. Our Association is becoming more and more important, and we have men skilled and able to say to the different roads that such and such a method is approved by our Association and should be adopted as a standard. We cannot come to this result in the first year, but I think that in the course of a few years our recommendations will be of equal value with those of other Associations.

Mr. Finley.—I would question very much whether it is the province of this Association to establish standards. I may be wrong, but I question whether it is the province of this Association to say that this or that type of structure is the one that should be adopted. I think we are treading on rather dangerous ground when we do this. It is all right to talk these things over, but to put this society on record as favoring this or that design, I would not recommend it.

President.—We have always been very careful heretofore to take this stand. Some of the members claimed that we ought in our committee reports to come out and make recommendation of some particular structure and take a vote as to whether we recommended that form. After a great deal of discussion it was finally decided that this Association could accomplish more good by discussing the

various types of structures, bringing out the good points of each, and let the roads choose themselves, as suited the particular locality or work that they had to do. Of course Mr. McGonagle's idea as to standing subjects and committees to be appointed yearly by the president is all right and would not conflict with the ideas suggested by Mr. Finley.

Mr. Finley.—I would ask if stresses for designing of timber structures have been adopted by this Association. I have heard it quoted that unit stresses were recommended by this Association.

Mr. Cummin.—Professor Kidwell made these tests but I cannot really say that they were adopted by the Association. I do not believe that we would do ourselves justice to adopt them, because there are some of them you would not want to adopt. I do not think it just right that this Association has recognized them as a standard.

Mr. Schall.—The idea in my opinion is that we are looking around for the best on each subject and in a great many cases the subjects are handled in a perfunctory manner. By having permanent committees I am quite sure that a complete report can be made on timber trestles. There are improvements made relative to any subject; they are liable to come up any day, and for that reason I think these subjects should be assigned to standing committees and from year to year they can be worked out and reported on.

Mr. Alexander.—Mr. McGonagle's recommendation, I think, is a good thing, and I heartily agree with and endorse the recommendation of having a subject carried on from year to year and having a committee appointed on these subjects and not drop them out. I know that at some of our meetings things that we would like to hear are not brought up. I would approve of this idea and I think that our Association would be benefited by it.

Mr. A. S. Markley.—In line with Mr. Alexander's remarks I think the president should at each meeting ask

the members if they have anything to offer the Association, what has come up during the year that was difficult for them to overcome and how they did it, and not confine ourselves to the listed subjects. Have a sort of an experience meeting.

President.—I am afraid that two or three of our good talkers would get up and talk for a week.

Mr. A. S. Markley.—Limit them to ten minutes.

President.—The committee on subjects for next year will report in about an hour; Mr. McGonagle will have his report ready by that time, and then we can vote on that matter and settle it. Next on our program is a paper by Mr. W. H. Finley, Principal Assistant Engineer of the C. & N. W. Ry. Co., on "The Evolution of Railroad Bridge Building."

"THE EVOLUTION OF RAILROAD BRIDGE BUILDING."

Address by Mr. W. H. Finley, Principal Assistant Engineer of the C. & N. W. Ry., given before the Association of Railway Superintendents of Bridges and Buildings, assembled in their Fourteenth Annual Convention at the Sherman House, Chicago, Ill., at their Thursday morning session, October 20, 1904.

Mr. President, Members of the Association of Railway Superintendents of Bridges and Buildings, and Ladies:

When your worthy president, something less than a year ago, asked me to prepare a paper on the subject of the evolution of railroad bridge building, I easily agreed, as the time seemed so far off, but the time has passed very rapidly and I now realize that, as we were taught in youth, "Procrastination is the thief of time." Mr. Samuel J. Tilden, I understand, attributed all his success in life to a systematic habit of procrastination, but on this occasion I rather disagree with him.

In taking up a subject like the evolution of railroad bridge building, it can be looked at from several standpoints. Treated in a historical manner you could fill several volumes. I will therefore confine myself to the practical development of bridge building and, in taking this up, the first class of structure to be given attention would, of course, be the stringer bridge. That is the simplest and most elementary form of bridge, whether sup-

ported on piles, mud-sills or bents, and its very elementary character prevents any marked change or development in its construction. I think, however, that the bridge used today does show some improvement over the earlier type, and I think it is well to note this fact when you speak of establishing standards by this Association. The earliest pile or stringer bridge was, I think, the bolster bridge, and that is rapidly passing out of use with the roads that have had the most experience with them. I understand, however, that a committee of the American Engineering and Maintenance of Way Association in its report recommended the bolster form of bridge, but I also understand that this report has not been accepted by the Association. I am rather surprised at this action of the committee, as it is a step backward, and, furthermore, I do not believe that any body of men should try to establish standards, as standards change too rapidly, and every man should have the privilege of using his best judgment. I have had a good opportunity to study the effects of the corbel bridge and I think that it is mechanically wrong and not founded on good engineering principles. Another point in the development of the stringer or pile bridge was the abandoning of mortising and tennoning of the caps and piles or caps and posts. I judge that this had its inception in the practice of the millwright, as that is the preferred form in mill building, and our early bridge builders were drawn from the ranks of the millwrights and the habit of mortising and tennoning was continued for several years. It contributed nothing to the strength, stability or life of the structure; on the contrary, it lessened the life of the structure, but it took a good many years to convince some of our bridge men that this was the case. I believe it is practised to some extent yet on some of our roads, but it has been abandoned by all the roads that have given any attention to the subject, as it adds to the expense of the structure without giving it any additional strength or stability.

The next change, which was marked and which brought about increased life to the structure, was the manner of bracing the pile bridge. The earlier types were very faulty in this respect. They lacked particularly in sufficient longitudinal bracing and the piles stood up like so many matches, and often the bridges went down as if they had been so many matches. The increase in weight of motive power and the introduction of high power brake equipment made necessary a better and more substantial form of bracing, and today in our modern structures that has been given very close attention, and structures now are provided with a very efficient system of longitudinal bracing. Of course, as I said, this structure is rather an elementary one and does not admit of radical development. There have been changes in the number and spacing of the piles, larger caps used and better bearing secured for the stringers, and, although we are now compelled to go to the coast for our stringers, we get the advantage of double length stringers.

The next type of bridge, following the stringer bridge in railroad bridge building, would be the wooden truss bridge, and that has been represented by a number of different types, but the survival of the fittest is represented today by the Howe truss. The earlier wooden bridges, before the date of the Howe truss,

from their very construction possessed inherent defects that prevented them from being used under increased loading. There are many that deserve a passing mention because they represent a development of this type. The McCallum type has been built up to 200 feet in length and one of the members has very kindly given me a copy of a drawing of a McCallum bridge that he built in 1857. This indicates the very short time that has elapsed in the evolution of railroad bridge building when the time is covered by one generation. These bridges were used over the Mississippi River and there were a number of spans over 200 feet in length. They were there for a period of ten years and gave satisfaction up to the time they were taken down, but they were not a form of bridge that could be continued. The Howe truss came in and met all requirements. It has been gradually improved upon, but the style remains essentially the same as when originally designed. I think the most important improvement was the abandonment of the tube on the angle block. I know that the old Howe truss bridge men think that these tubes were necessary, but they performed no legitimate office, they increased the cost of the structure and made more framing necessary, and it might be said to be an axiom in wooden bridge building that no amount of framing is going to add to the life of a bridge. It adds to the cost, but does not add to the life, so that design is the proper one which makes necessary the least amount of framing or cutting and in leaving off the tubes there was a point gained. There are a great number of bridges that have been in use for twelve years that have been built without them and, as far as my observation goes, I think them superior to the other form. I have seen a number of bridges, particularly the Howe truss bridges, where they used extremely thin sticks in the chords, framed out to meet these tubes to such an extent that you could not lift one of them by the end without breaking it. Other improvements were made in the better arrangement of the joints in the bottom chords and in better and larger bearings, involving less pressure on the timbers, and also in using end batter posts. I think, however, that all bridge men will agree with me that the Howe truss, outside of its liability to fire, is a very satisfactory structure. It never went back on a man if he exercised any system of inspection. If it became weak, it gave you ample notice, and to that extent was a very reliable structure. I have taken down Howe truss bridges ranging from 27 to 31 years old, and I think they compared very favorably with other styles of bridges. These were covered bridges and the timbers were, of course, protected to that extent, and were sound and in good condition when taken out. These bridges were taken down for the same reason that we have taken down steel bridges, on account of heavier structures being needed. I think that the trestle and Howe truss bridges about close up the wooden structures as used by railroads, and I will now pass to the development of iron and steel structures that are now in use, and will take up the simplest form first: the plate girder.

This also does not admit, from the nature of its construction, of very radical changes in its development, but there have been marked improvements in design until the structure, as used to-

day on our modern railroads, is a very great improvement over the earlier type. Some of these changes were in using heavier web plates, a better and more scientific arrangement of the stringers and a better form of bearing under the end supports. Some improvement has also been made in eliminating the cover plates by using a top flange that did not require them, thus rendering unnecessary the dapping and boring of ties, which was a slow operation when you wished to put in a bridge in a hurry. Of course the methods of manufacture have had something to do with the improvements in steel bridges, they having kept pace with the developments and improvements in the design.

We have now come to the truss bridge and will consider first the pin-connected type, as that represents distinctively an American type of bridge. There have been a number of different designs of pin-connected bridges, but they have gradually narrowed down to one selection and that is what is known as the Pratt truss in its simple or sub-divided form. While there were a number of others, they are now known only by name and the evident aim of the designer was to produce a bridge that was somewhat less in weight by a few pounds and cheaper by a few dollars and cents. That is a characteristic of the development of any new type of construction and after it is first brought out there is a great desire on the part of the designers to make the cheapest structure that can be made. After a few years they are glad to make a good, stiff, substantial structure without desiring to make the cheapest. As I say, the pin-connected truss is recognized as the American type of bridge and, owing to its construction, it has received a very thorough development and has spread all over the world. It can be manufactured in a shop in the eastern part of the United States, for instance, and shipped to the heart of Africa and put up by coolie labor—with one intelligent white man to direct them—without any difficulty, until today the American pin-connected bridge spans the rivers of Australia, bridges the waters of the Saskatchewan and the mighty St. Lawrence, pierces the sky line of the Argentine, as it spans the rocky gorges of South America, and can be found in the heart of Africa and in India on "the road to Mandalay." That is due, I think, particularly to the type and the ease with which it can be erected. In the development of this type it came down to the simple Pratt truss, and other special trusses, made to fit certain conditions, have gradually passed away. It has undoubtedly benefited in late years from improvements in design. The earlier types suffered from too small pins, which resulted in the cutting of the bearings, and in consequence there was a shaky and bad riding bridge. The bridge, as built today, is characterized by deep floors with large pins and with some attention paid to placing these pins; in heavier metal, better bracing, and in being more rigid, the adjustable rod bracing being superseded by the riveted form of stiff bracing, making a better and easier riding bridge for a railway company. Another point that has also received considerable advancement and development is the method of providing for expansion bearings at the ends. While this, of course, is characteristic of all types of bridges, I will mention it here. The earlier roller bearings consisted of very small rollers and were very unsatisfactory.

They did not roll; they would slip out, and in fact do almost everything but the thing for which they were intended. The rollers were next made larger until finally they went into the segmental roller. This was supposed from its large diameter to give a better bearing. These segmental rollers have been used extensively but have not in all cases given satisfaction. They will not always come back to position, and consequently the span slides upon them. There has been a form of roller used here in the West which offers a solution of that difficulty. It consists of using a segmental roller and placing a tooth in one or more of the rollers which engages a corresponding tooth in the shoe and base plate, making a sort of rack and pinion. They come back promptly to position, and, from what I see, I am also inclined to think that they act as well under changes due to temperature. While on this question of bearings I will say that I think one of the biggest improvements we have made in bridge building has been the adoption of an adjustable bearing for the end supports of the bridge. The old type of bridges built in the earlier years were not adjustable at the ends. They used a large base casting, the bottom pin passing through the same, and the end post built up against it, making a rigid support there. No provision was made for adjustment of bearing in changes of position due to deflection from passing trains. That form of bearing simply resulted in the shattering of our masonry. There are instances of masonry on roads having been entirely destroyed by the lack of some suitable provision for the expansion of the structure. This, with our adjustable bearing, is overcome entirely, I think, in our modern bridges. I have had occasion to renew any number of bridge seats simply owing to the fact that the expansion was not properly taken care of. In the early days of our steel and iron bridges we did not have a large number of trained experts such as we now have, and the figuring of the stresses in an ordinary truss bridge was considered somewhat of an accomplishment, and an engineer who succeeded in figuring out accurately the stresses in a bridge thought that he had done his duty, and it was left to some one else to design or make up the details, and in that respect the bridges suffered accordingly. Sufficient attention was not paid to the details, and they did not in consequence get anywhere near as strong a structure as they thought they were getting, owing to the eccentricity in the connections, which induced large secondary stresses, that were not at that time and are hardly now given the attention they should be in designing structures.

I will pass now to another form of truss bridge that seems to be holding its own: the riveted lattice truss. It has received considerable development in this country, but I do not believe there is any bridge ever built that has suffered more from unscientific and unskilful designing than the riveted lattice bridge.

It was largely, after the stresses had been figured out, a rule of thumb as to details. I know that I have before me some of our members who have a very high respect for the riveted lattice truss bridge and I am willing to join them in it, but I must say that in its earliest examples it was rather to the discredit of bridge builders. They paid no attention whatever in this multiple form of bridge to the neutral axes of the members meeting

at a point and the result was that the center lines might intersect three or four feet up in the air. This resulted in a bridge that was not stiff, and there are a number in use where the deflections, both vertical and horizontal, are altogether more than they should be and would lead one to think that the lattice bridge was not as strong a bridge as its admirers claimed. This is due almost entirely to the lack of care in designing, particularly at the hip joint where the hip suspenders and web members join. There are a number of examples where these were put in regardless of where they should come, and it was the same with all other web connections. They were spread so far apart that they induced what I spoke of before as secondary stresses and the bridge was not by from 25 to 30 per cent. as strong as the designer thought it was, or that he might think it was from the amount of metal he had in it. If the design was made on proper lines, it could have been given more strength with very much less metal. Another point in the lattice bridge that has received some attention is the floor. This bridge, together with the pin-connected bridge, suffered from the shallow floor system. Some of the examples of the lattice bridge with which I am acquainted I think have the most unscientific method of attaching floor beams that I have ever seen. It was the common practice to place the floor beam at the hip suspender to one side of the hip suspender, leaving a distance of about 12 to 14 inches between these two members, which meant a very heavy bending stress. They also lacked, as did the other trusses, sufficient lateral bracing. We must give more attention to the effect of unbalanced parts of a locomotive going across a structure at the rate of 60 miles per hour. I think the bracing should be of sufficient strength to cause that structure to resist these loads as a whole instead of in parts. In bridges being built today that is being recognized, and they are using much stiffer and much larger and better bracing. In the West, for spans under 200 feet, the lattice bridge is being built very extensively and it gives very good satisfaction from the practical standpoint, and from the standpoint of maintenance, but it is not as cheap in first cost as the pin-connected type.

There is another type of structure that is not as numerous as the other truss bridges that should be given some attention, and that is the steel viaduct. Some of the earlier trestle structures with short spans—20 to 30 feet—were made of riveted lattice. They have given way to the plate girder superstructure, and the light adjustable rod has given way to heavy angle iron and other forms of bracing.

There is another type of bridge that is used by railroads and in which I am not positive whether any improvement has been made or not; I now speak of the masonry arch. Without doubt the early engineers and masons were very skilful and the examples that we have of the stone arch reflect credit upon the designers and builders. It seems that it is being given more attention now on the older railroads and is being built extensively. That place on the Delaware River, where George Washington pushed the cakes of ice out of his way, is now spanned by a stone arch bridge and is a very fine example of work of that character; and at the Susquehanna River there is one of the

largest stone arch bridges in the world. One of our members was kind enough to give me a set of plans of what were called standard plans for a railroad here in the West. These standard plans were made in 1857. Of course they are not up to date, but the examples they give of stone arch bridge construction are wonderfully good.

The competitor of the stone arch bridge, and of stone masonry generally, is concrete. That, as we know, has received a big development of recent years, and I will say that, personally, I think it is the coming method of construction. I use that term advisedly. I know there are a number of gentlemen present who are confident that it has already arrived and I think that after years of experience we will look at it more kindly than we do at present and get better results from it. As I spoke of the East showing such magnificent examples of the stone arch bridge across the Susquehanna and Delaware rivers, I might say that one of our Western roads, the Illinois Central, shows a fine example of the concrete arch bridge of 140-foot spans. Yet scarcely has concrete taken its place as a form of construction than in comes a modification of it known as reinforced concrete, and reinforced concrete is passing through the same phase of development that our earlier steel bridges passed through. The sole object of every designer in past years was to design a truss that would have less weight than any other truss and when he had accomplished that purpose he was satisfied that he had done something good. There was a great rivalry to get up a form of truss that would have less weight than any preceding one. The same phase is noticeable in the development of this reinforced concrete. Every one who is giving any attention to it is citing its cheapness and small dimensions, and how much cheaper it can be built and how much less material is required. I think that will have its day and we will not then pay so much attention to saving so much concrete or so many dollars and cents in its construction. There is no doubt but that it has a big future before it. It has a big field to occupy and will, I think, occupy it in time. It lends itself readily to all forms of construction and I think, after we have had more experience with it and can check up on actual examples, we will probably have more confidence in it than we now have. It can be used, and is used, very extensively in arches, abutments, piers, and also as a covering for deck structures and other structures where ballasted floors are used, and this seems to be a very good use for it. This permits the use of ballasted floor structures without bringing the ballast in contact with the metal, and thus prevents the consequent corrosion of the structure. The ballasted floor is coming largely into use in small spans, and some of our roads are providing for ballasted floors on even their large truss spans. I think a railroad today that puts in an open floor on short spans on its main lines is making a mistake. They can at slight additional cost put in the ballasted floor bridge that will make a better and safer riding track and largely reduce the cost of maintenance. A 20-foot open bridge has just as many ends to it as a 300-foot span and requires just as much attention in keeping them up. The use of the ballasted floor does away with that entirely and

puts that part of the road-bed, as far as maintenance is concerned, on the same basis as the remainder.

I will go back in my talk and take up again the subject of wooden trestles. Ballasted floor trestles are being used, and I am of the opinion that, with treated piles and caps and treated plank covering, it will prove not only a satisfactory structure but an economical one, especially in places where by nature of the traffic on the line, or some special conditions, it is not required to put in a permanent structure. In this way you can extend the life of a bridge very much on economical lines and get a very safe and secure structure so far as traffic is concerned.

To continue on the subject of reinforced concrete: we have examples in this city of stone masonry retaining walls being built 12 and 13 feet high, that are six and seven feet wide at the base, and have other examples where they are building reinforced concrete walls that are about 18 inches wide at the base. It presents such marked contrast that an engineer is compelled to question whether both are right. I would simply caution the friends and admirers of reinforced concrete to go a little slow, to be sure of their position and not try to make the cheapest form of bridge that they can make in that form of construction. I remember hearing yesterday a report from one of your committees in which I think it was stated as their opinion, or the opinion of some of the members, that concrete construction was entirely satisfactory for abutments and piers, and that they were using it for bridge seats and coping instead of stone, and found it to be giving satisfaction. Personally, I can see no reason why concrete, properly built, would not give satisfaction under such conditions, and why it would not give just as good results as a great deal of the stone that we get for bridge seats. I think that concrete with rail or any other form of iron imbedded in it would give very satisfactory results.

I do not know that I can add anything more to this very short talk that I have given you on the development of bridge building. It could be extended indefinitely, but I do not believe it would be of sufficient interest to take up the time of you gentlemen and I will simply close, thanking you for your attention.

Reading followed by prolonged applause.

Mr. Ingalls.—I move that we, as an Association, tender a vote of thanks to Mr. Finley for his very able address.

Carried unanimously.

Mr. Finley.—I appreciate very much the mark of appreciation shown me by the society and I will say that the reason why I did not prepare a formal paper on this subject was that I did not know where to stop and I thought it would be better to talk to you without notes than otherwise,

because then I could tell from your expressions when it was time to stop.

President.—We will now listen to the report of the committee on subjects for our next Convention.

Mr. McGonagle read the report.

SUBJECTS FOR REPORT AND DISCUSSION FOR 1905.

To the President, Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

Your committee appointed to select subjects for next year's meeting beg to submit the following subjects for consideration:

1. Construction and maintenance of docks and wharves.
2. Relative value of concrete and timber piles.
3. Concrete building construction, including platforms.
4. Anchors for plows and derricks.
5. Methods of repairing roofs of various kinds.
6. Methods of watering stock in transit.
7. Protection of water tanks and water pipes from action of frost.

STANDING COMMITTEES.

1. Pile and framed trestle bridges.
2. Steel bridges.
3. Buildings.
4. Docks and wharves.
5. Water supply.
6. Fire protection.
7. Fences, crossings and cattle-guards.
8. Preservatives for wood and metal.
9. Coaling stations and cinder pits.
10. Records and accounts.

W. A. McGonagle,
A. E. Killam,
C. W. Vandergrift,
D. C. Zook,
H. M. Tripp,
A. E. Doucet,
James McIntyre,
H. W. Fletcher,
Committee.

Mr. A. S. Markley.—It looks to me as if we were getting more subjects than we could get through with.

Mr. McGonagle.—We will merely get a report from time to time from the standing committees as they get new in-

formation. Perhaps some of the committees will not have a report for two years from now.

Mr. Lichty.—As I understand it, the standing committees are to report on new improvements which come up from time to time which would be of interest to the Association.

Mr. McGonagle.—My idea of the standing committees is that they should look for additional information on all the subjects presented. This information should be submitted to the Association from time to time as obtained. It is not necessary to have a report on any one of these subjects, but if the committees find material of interest they should report from year to year. They can be discussed or not as desired.

Mr. A. S. Markley.—It keeps adding improvements all the time then and is a good idea.

Motion made to accept the report was seconded and carried.

Mr. Steffens.—In reading the reports and listening to the discussion, I have been impressed with the idea that a great deal too much extraneous matter is brought in in connection with the subjects and that perhaps the pruning hook could be used with good effect by the editing committee. I should like to hear the opinions of the members on this. In comparing our records with those of other organizations of a similar nature that fact has been very much impressed upon me during the past year.

President.—You might make a motion to cut down everybody's words in excess of 100 words. I think myself that the time is soon coming when we will have to limit the remarks of any one present to a certain number of minutes, for our Association is growing and in order to give every one a chance we will have to limit the time of their discussion.

I think that this concludes all business of the Association except the election. You have heard the report of the nominating committee. Is there any one else who wishes to make additional nominations?

Mr. A. S. Markley.—As there are no other nominations I move that the secretary be instructed to cast one ballot electing these officers.

President.—Before putting that motion I wish to make a few remarks. Mr. Shane was first vice-president of this Association last year and some of you, I know, will wonder why he has not been nominated for the presidency. I know of my own personal knowledge that Mr. Shane has stated, before this matter ever came up, that he could not accept the nomination if it were given him, and, merely to place him right before the Convention, I am going to ask him to make a few remarks so that we can all understand the situation as it is.

Mr. Shane.—I am sure that I appreciate the favor that our president has conferred upon me and in stating my position I wish first to impress you with the fact that it is not because I fail to appreciate the great benefits I have received in being able to participate with this Association as far as it has been in my power. I appreciate fully the great advantage that men in our profession have in being able to come together and interchange our ideas. A number of years ago, in 1899 and 1900, a few of our old practical heads reached the conclusion that in this progressive age in order to keep abreast of the times it was necessary to have some source of acquiring more up-to-date ideas. Hence this Association was organized in 1890 and, as an evidence of the correctness of the ideas of these gentlemen, we have but to compare the work of this Association as it has been put forth from year to year. We can see how wonderfully it has developed and each and every member today I believe has been benefited by it, so that the hopes of the originators of this Association have been more than fulfilled. I assure you that I appreciate any honor that this Convention might confer upon me, but I would not be so selfish. I place the welfare of this Association far above any selfish motives. In 1891 this Association asked me to act as its secretary. Knowing full well the

importance of that office and being satisfied that I could not devote the time and attention that the work deserved, I thanked them for the offer and declined and placed in nomination the present secretary and the wisdom of that act needs no verification. Now then, gentlemen, while I duly appreciate the honor of being made president of this Association I feel that I could not so sacrifice the interests of the organization. I am peculiarly situated so that I could not devote the attention that would be necessary to it. It is with the greatest difficulty that I have been able to meet with you at all and I have not been able to meet you at the last few conventions, so you see the Association affairs would suffer in consequence. And again, I have carefully considered the matter and I have resolved that I will retire from railroad service. I feel that I have reached an age in my life when, if I go much further, I will be confined for the rest of my days to the Bridges and Buildings Department, and I have reached an age also where, if I should lose my position, it would be very difficult for me to secure anything satisfactory to myself. You all know the position that railroad companies have taken in regard to employing elderly men. I will therefore retire from railroad service and probably during the ensuing year, and I would not therefore be in position to take part in our next Convention. It is highly probable also, and I say it with much regret, that I may not meet with you again. I thank you all, gentlemen; I am glad that I have met with you; I am sorry that I have not been able to get better acquainted. I am sure I wish you continued success.

President.—Going back in our remarks to the motion made by Mr. Markley, the motion was that the nominations be now closed and that the secretary be authorized to cast one ballot for the gentlemen named in the report of the nominating committee. I will have to ask some one who is not being elected to cast this ballot. I will ask Mr. Riney to do this. Any one can object to this and require a regular ballot.

Mr. Riney.—I so cast the ballot.

President.—The ballot is cast, gentlemen. As far as I know that completes the program. Is there anything further at this time? There will be a meeting of the executive committee at 11.30 in the parlor on our right. In bidding you farewell as president of the Association I want to say only a few words. This Convention, as you know, has been very successful and I want to state that the success is due to the fact that all the members and the officers have worked together in producing this result. There has been absolute harmony in all our transactions and that I think accounts for our success more than any other thing that could be mentioned. I know that the Association will be in good hands and I have the honor of introducing to you our new president, Mr. C. A. Lichty.

President (Mr. C. A. Lichty).—Gentlemen: I fully appreciate the honor you have conferred upon me in electing me to the highest office of this Association. I was pleased to have Mr. Riney cast the vote. It was he who induced me to attend the Convention at Detroit in 1899 and cast the vote making me a member. Since that time I have taken an active interest in the work, enjoying it more each year, and have been for several years chairman of the committee for soliciting new members. This has been the banner year, having added to our list more than 90. Most of the credit, however, is due to the unceasing efforts of our retiring president, who wrote personal letters to managers of nearly every railroad in the country, setting forth the aims and principles of our work.

I shall give to the work for the coming year my best efforts and I have only to follow in the footsteps of my worthy predecessors. If I were to hang before you a motto for the coming year's work, I would hang over here to the left the motto of this great city, "I WILL," and over here to the right, "DO IT NOW"; then directly in front, "PROCRASTINATION IS THE THIEF OF TIME."

I hope that each and every one of you will think of these words when you are called upon by the chairmen of the various committees for information, and I think we can make the next convention quite a success if we will all try. I wish to thank you one and all. (Applause.)

The officers were then declared elected and each accepted the office to which he was elected. Secretary Patterson, being called upon, responded as follows:

Secretary Patterson.—Friends and Brothers: I wish to say that I appreciate the honor which has been conferred upon me for another year. Mr. Shane's remarks have carried me back very forcibly to the Cincinnati convention. I came away from there more than surprised at being elected secretary and it is certainly a great source of satisfaction to me to know that I have been so heartily supported by the loyalty of all the members and have been continued from year to year, and that I have apparently earned your confidence. The motto suggested by our president, that "procrastination is the thief of time," is especially applicable, where the duties of the secretary are concerned, and it would be a great pleasure and help to me if the members would send their reports in promptly. It is very confusing to have them come in at the last moment and I hope that the committees will make a special effort to prepare their reports early. I would be glad at any time to receive suggestions from members of the Association, pertaining to the betterment of the affairs of this office. Gentlemen, I thank you. (Applause.)

Mr. J. H. Cummin.—There is one thing that I have on my mind, which has been the custom at all our annual conventions where the chairman of the entertainment committee has fulfilled the duties that are his in the manner in which they have been fulfilled in the present instance. As you all know, the transportation facilities between Chicago and St. Louis have been very much restricted on account of the fair. Mr. A. S. Markley has been chairman of our entertainment committee. He has worked hard

and successfully so that we could enjoy a pleasant trip to St. Louis. This has been hard work and I think it would be appropriate for this Association to get up a testimonial for Mr. Markley and his wife to show our appreciation.

President.—I wish you would take some action on this.

Mr. Montzheimer.—I would make a motion that all the members who care to show their appreciation of Mr. Markley's efforts as chairman of the entertainment committee kindly go to Mr. Cummin and leave a small donation which will go toward buying a present for Mr. and Mrs. Markley.

Seconded by Secretary S. F. Patterson. Motion unanimously carried and recess taken to give members a chance to see Mr. Cummin.

President.—I believe the committee on resolutions is now ready to report.

REPORT OF COMMITTEE ON RESOLUTIONS.

Your committee begs leave to report as follows:

Resolved, That the thanks of this Association are hereby tendered to the following roads for the courtesy of free transportation extended to the members over their lines to and from the Convention:

Boston & Maine Railroad.
Erie Railroad.
Grand Trunk Railway.
New York Central & Hudson River Railroad.
New York, Chicago & St. Louis Railroad.

To the Pullman Company for the courtesy extended to the members of half-rate sleeping car transportation and special accommodations furnished on the trip from Chicago to St. Louis and return.

To the Illinois Central Railroad for their kindness in furnishing a special train to convey our members and friends to the Illinois Steel Works and return.

To the Illinois Steel Company for providing an opportunity for inspecting their works.

To the Illinois Telephone Company for their kindness in furnishing cars and facilities for inspecting their tunnels and switchboard at Chicago.

To the Western Society of Engineers for their kind invitation to visit and make use of their meeting rooms.

To the local committee of arrangements, Mr. A. S. Markley and Mr. R. C. Sattley, and to our good friends, Messrs. Nichols, Dickinson, Johnson and others of the supply men, who have so kindly assisted in furnishing entertainment for the ladies as well as to the members of this Association while in Chicago.

That our most sincere thanks be extended to Mr. R. R. Ham-

mond, second vice-president of the C. & E. I. R. R., for the special courtesies shown to the Association in furnishing free transportation from Chicago to St. Louis and return at a time when their line is so heavily burdened with the regular traffic.

Respectfully submitted,
R. H. Reid,
R. C. Sattley,
J. P. Canty.
Committee.

Motion to accept report seconded and carried.

There being no further business before the Convention, adjournment was taken, on motion, to the third Tuesday in October, 1905, to meet at Pittsburg, Pa.

S. F. PATTERSON,
Secretary.

P. B. Ransom,
Official Stenographer.

DISCUSSION OF COMMITTEE REPORTS

FOR 1902-1903.

CONTINUED FROM THE THIRTEENTH ANNUAL CONVENTION.

1.—Best False Work for Rocky Bottom in Rapid Currents Where Piles Cannot be Driven.

(No discussion.)

2.—Should Ties of Bridges be Gained so as to Leave Rail Without Camber, or Should Only a Portion of the Camber be Taken Out?

Mr. Burrell.—I hope that some one will have something to say on this question. We have a bridge across the Elkhorn River in Nebraska that has 1¾ inches camber. We gained the ties and I cannot see that there is any great detriment to the ties or in the appearance of the surface of the floor, all parts being in as good condition as when put in three years ago.

Mr. Alexander.—In last year's discussion there was something said about bringing the opinion of the superintendents of bridge and buildings to the designers of the bridges. If a bridge cambers two inches, it looks bad and rides badly. It is not necessary to incur the expense of gaining the ties on a bridge if it has proper camber. That is what I believe the Convention decided last year. That being the fact, we had better design bridges so that they will have just the amount of camber that is needed, and they will then be all right. Some one spoke about track being level when not loaded. You cannot have a bridge

look level and ride well. With the old Howe truss bridge I found that it used to sag down near the pier and you would feel the car go up and down when you rode over each pier.

Mr. Killam.—In constructing bridges in Canada we aim to have the camber equal to the deflection of the bridge when load is on it, and then all the ties are made of equal depth. We give a camber equal to the deflection, so that when the greatest weight is on it it is level. Our bridges are built with a little camber in them. There were a few put in with too much camber, and then we had to size the deck. All the new ones are put up with the camber equal to the deflection as near as possible.

Mr. Reid.—I think that without question almost all of the old iron bridges had too much camber. The designers possibly thought the bridges would sag, as wooden bridges do, but I believe that the present practice in steel bridge design is to put just enough camber in them so that the bridge will come down level when fully loaded.

Mr. Penwell.—I think the committee's report of last year reached the correct conclusion and I agree with Mr. Killam's remarks. Two years ago we placed some 85-foot spans that had 1⅝ inches camber. A short time after that our chief engineer went over them and complained of bad surface. We then took out all of the camber except that which was necessary to leave the rail straight under the heaviest load. In 40-foot spans we frame straight; in 85-foot spans we leave ⅝-inch and intermediate lengths in proportion. I derived this rule by noting deflections under the heaviest loads which we have and find it very satisfactory. I can see no necessity for having any more camber than enough to overcome the deflection. The bridges lately designed have correct camber, showing that the designers recognize this point. Our old bridges had as much as 1¼ inches camber. We frame that all out now except enough to overcome the deflection.

Mr. Kelly.—I should like to ask Mr. Reid whether he

finds any drift in the track when he has taken the camber out. In other words, whether he finds the rail creeps on his double track and all in one way with the direction of travel?

Mr. Reid.—I do not think we have ever given that question any attention in connection with camber. The rail does move on some bridges but I do not think the camber makes any particular difference. On some bridges we have put on clamps, drawbridges especially, but I do not think the camber has had any effect on the creeping of the rail.

Subjects 3, 4, 5, 6, 7, 8 and 9 passed without discussion, as follows:

3. In case one arm of an important metal drawbridge over a deep stream should be wrecked, what is the most expeditious way to restore railway and water traffic?
4. What is the best form of traveler to use in erecting steel railway bridges of spans up to 200 feet?
5. Best method of protecting solid steel floors of bridges.
6. Best plans for small tool houses, including switch- and hand-car houses.
   men's and car repairers' shanties, and section, tool
7. Best practical sanitary arrangements for small stations where there are no water or sewer systems.
8. Best method of making annual inspection of bridges and culverts, and form of report to be made.
9. Water filters, or other methods of purifying water for engine use.

COMMITTEE REPORTS

FOR 1903 AND 1904.

PRESENTED AT THE FOURTEENTH ANNUAL CONVENTION, CHICAGO, ILL., OCTOBER, 1904.

1.—What is the Best Form of Traveler to Use in Erecting Steel Railway Bridges of Spans up to 200 Feet?

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

After considering in a general way methods followed by different railway companies and contractors in the erection of bridges within the limit of our subject, it was decided that in order to cover the field fully our inquiries must definitely include derrick cars and similar equipment, as well as the type usually called travelers.

The replies received represent railroads having a total of about 90,000 miles of main line. Those companies which are definitely committed to the erection of steel bridges with their own men and equipment comprise lines covering about 55,000 miles. Those companies, which have contractors do their erecting, comprise lines having a total mileage of about 30,000 miles. It is thus evident that more than 60 per cent. of the mileage represented by the replies received is committed to the policy of erecting its own bridges, and this fact assures the interest of our Association in the discussion of the question. In many cases the companies, which do their own erecting, limit this practice to girder bridges and in some cases to the short girders. This limitation, however, does not apply to a large percentage of the total mileage, but it is found that, out of the 90,000 miles represented by replies received, over 35,000 miles apply to systems which erect all their own steel bridges.

The use of the derrick car is quite generally advocated in the replies received, but the extent to which it is used is varied according to circumstances. The Chicago & North Western Railway, the Illinois Central Railroad and the Chicago, Burlington & Quincy Railway companies, representing a total of approximately 15,000 miles of line, have practically adopted the derrick car as the best equipment for erection of all classes of steel railway bridges within the limits of our subject. This means not only girder bridges but through truss bridges as well.

The drawings and photographs, which we have been able to accumulate, would indicate that there is very little to discuss in the comparison of one overhead traveler with another. They also indicate that, so far, at least, as essential elements are concerned, there is very little to discuss in comparison of one derrick car with another. It would therefore appear that the discussion of the subject assigned to your committee will develop into a discussion of the comparative merits of derrick cars and through travelers. The following is a summary of the points which have been given consideration by your committee:

(1). Adaptability. Years of experience have shown the overhead traveler to be perfectly adapted to the erection of through and deck bridges. Its general type is well known and simple It is generally conceded, however, that for girder bridges the derrick car is better fitted.

(2). Interference with traffic. It is claimed by the advocates

of the overhead traveler that this type of rig interferes less with traffic and is, therefore, preferable for use on lines where trains are frequent. A derrick car, in order to meet the requirements placed upon it, must be self-propelling, and if the turnout has been constructed in close proximity with the bridge, the interruption to traffic should not be much, if any, greater than that occasioned by erection with an overhead traveler. A self-propelling derrick car will, in many cases, take the place of a work train and result in less interference to traffic for that reason.

(3). Cost of preliminary preparations. The additional cost in case of an overhead traveler is represented by the extra width of falsework to provide a runway for the traveler, and by the cost of erecting and taking down the rig. The extra cost in case of derrick car consists of the provision of spur track at the site for the use of the car.

(4). Economy in operation. Your committee did not take up the investigation of this subject early enough to enable it to gather reliable information regarding costs, but will submit its opinion to the effect that in the erection of girder bridges and trestles a derrick car is by far the cheapest form of rig to be used and that for the erection of truss bridges a derrick car is, to say the least, no more expensive in operation than an overhead traveler.

(5). Permanent investment. As a permanent investment the overhead traveler is much less than the derrick car, but the derrick car can be used in so many other ways when it is not engaged in the erection of bridges that it is found by those who have used it to be a most valuable tool to have in the department.

The following are some of the reports which your committee has decided to submit in full.

Your committee realizes that the investigation of this subject has not been as thorough as the merits of the case and the interest of the Association should require. We hope, however, that our report, together with such drawings and photographs as we have been able to accumulate, will be sufficient to draw out a valuable discussion.

G. W. Smith,
Moses Burpee,
Geo. J. Bishop,
A. O. Cunningham,
J. C. Hain,
I. F. Stern,
Committee.

APPENDIX TO COMMITTEE REPORT NO. 1.

ADDITIONAL INFORMATION BY LETTERS.

CHICAGO & NORTH WESTERN RY. CO.

CHICAGO, October 11, 1904.

Mr. G. W. Smith, 1247 Monadnock Block, Chicago, Ill.

DEAR SIR: Answering your inquiry of October 10, regarding derrick cars used on this road for the erection of steel bridges. We abandoned some years ago the use of the old form of traveler for bridge erection and substituted derrick cars therefor. We have a number of derrick cars at work on the system in the erection of all classes of railway bridges from plate girders to pin and riveted truss spans. I enclose blue prints of our heaviest derricks. We have a number of other derricks of somewhat less capacity on the same general lines. I also enclose some photographs showing these derricks in action.

Trusting this information will be satisfactory, I remain,

Yours truly,

W. H. FINLEY,

Prin. Ass't Engineer.

Enc.

CANADIAN PACIFIC RY. CO.

MONTREAL, October 10, 1904.

G. W. Smith, Esq., 1247 Monadnock Block, Chicago, Ill.

DEAR SIR: In reply to circular letter of your committee of the Association of Railway Superintendents of Bridges and Buildings, dated October 6, I would say that I consider the use of a traveling derrick car the most economical and quickest method of erecting spans, both deck and through, up to 200 feet in length; also for the erection of steel viaducts consisting of towers and spans.

It does not require additional falsework or runway, as in the case of an ordinary straddling traveler, and material can be picked up on the shore and run out and assembled in place very much quicker than with the ordinary traveler.

I am sending you a blue print of a traveling derrick which has been found very handy for erecting spans on new lines where there is no traffic to be maintained. It consists of two wooden brace-frames, spaced 9-foot centers, supporting a platform for hoisting-engine and air compressor, with a clearance of about 7 feet above top of rail, which allows of material being run through beneath the derrick on push-cars and picked up and assembled with either or both of the booms. This derrick is moved by means of an anchor rope wound around the drum of hoisting-engine.

I am also sending you a drawing of a straddle traveler and a gallows-frame which we frequently use for erecting deck plate girders and lattice spans up to 100 feet in length.

Yours truly,

C. N. MONSARRAT,

Engineer of Bridges.

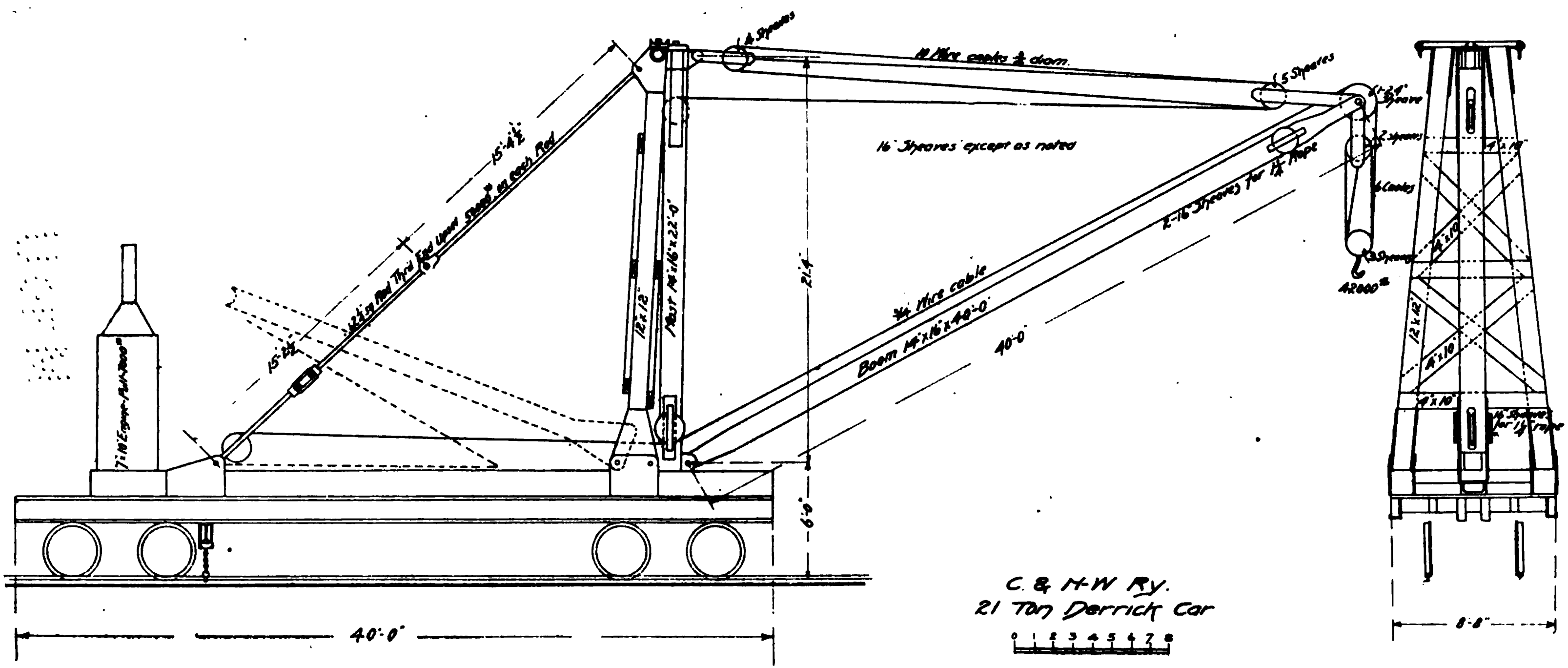


FIG. 11.—Twenty-one Ton Derrick Car, C. & N. W. Ry.

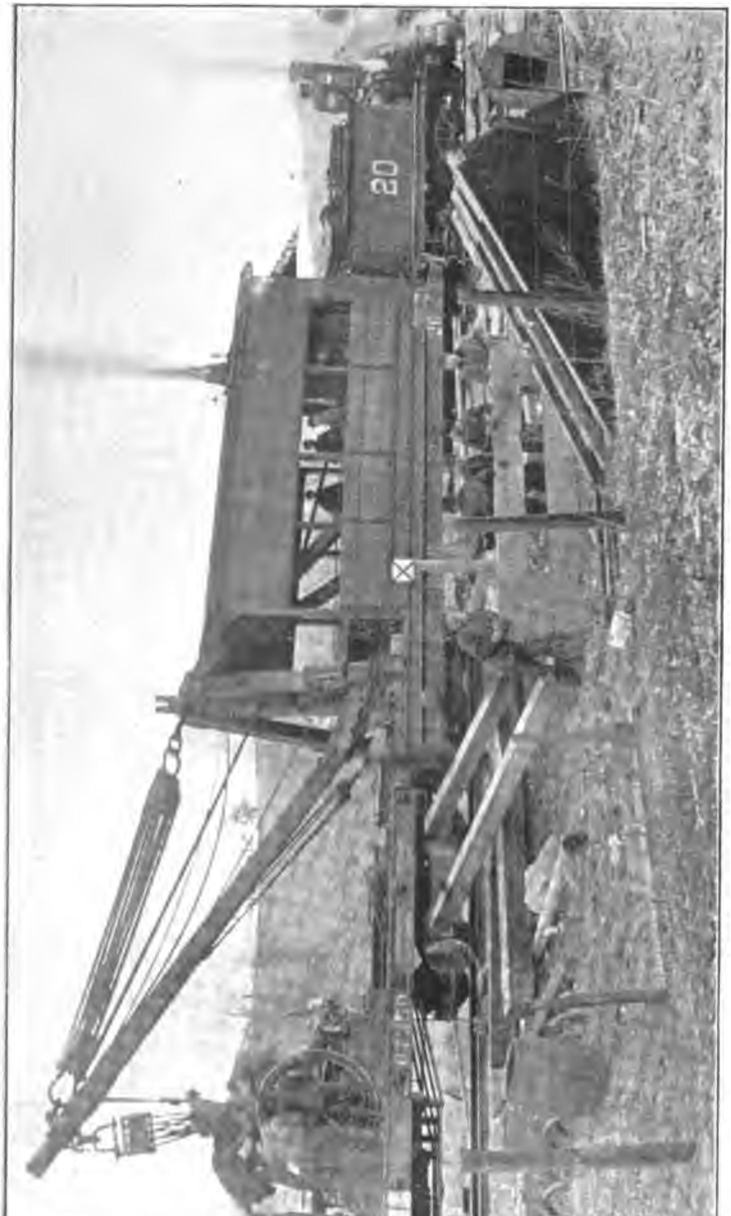


FIG. 2.—Derrick Car, Ill. Cent. R. R.

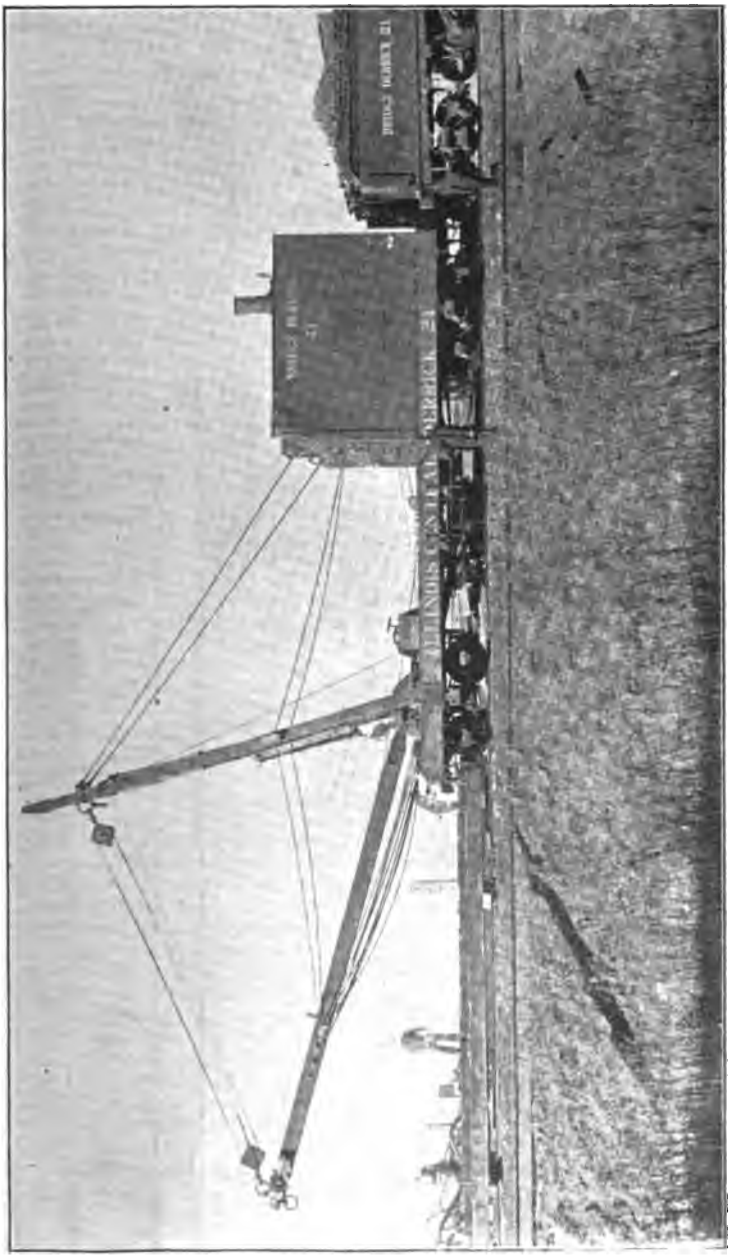


FIG. 3.—Derrick Car, Ill. Cent. R. R.

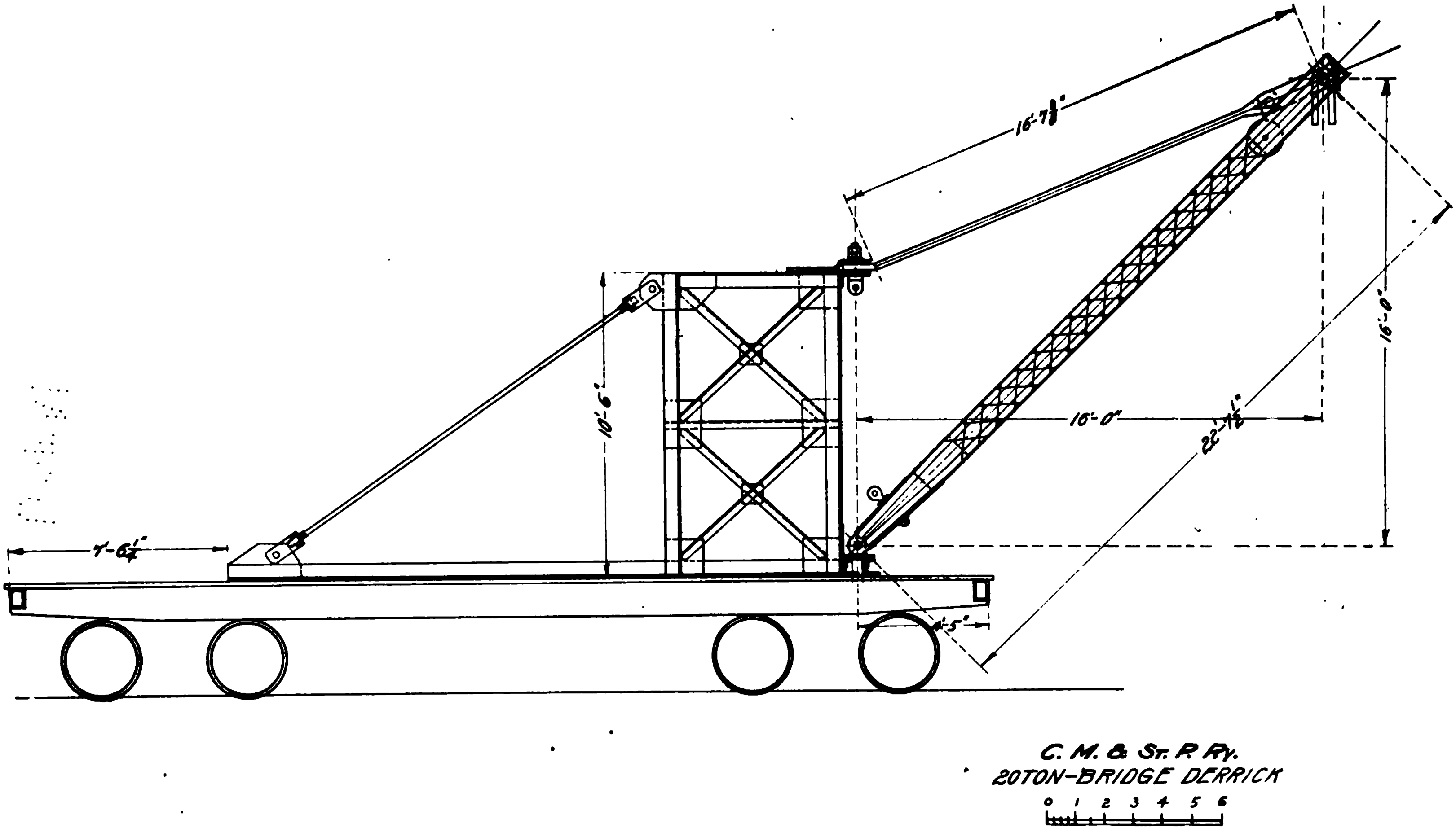


Fig. 4.—Bridge Derrick, C. M. & St. Paul Ry.

ERIE RAILROAD.

NEW YORK, October 12, 1904.

Mr. G. W. Smith, 1247 Monadnock Block, Chicago, Ill.

DEAR SIR: Your circular, dated October 6, asking for a report and information on the best form of travelers, etc., is received and I answered you a few days ago, signifying my willingness to submit a report. I am sending with this report a sketch of a traveler with booms which I find very successful in the erection of truss spans and short girder work or viaducts with short benches. This is more especially designed for rebuilding work, where maintenance of traffic has to be considered in preference to the progress of the erection. For new roads, this could be used to good advantage on small light work, but, as your circular seems to lay more stress upon new work and building new lines, the only form of traveler that I have had any experience with on this kind of work is the cantilever style. This style of traveler can be used under any circumstances for any kind of work, the only question being whether the amount of investment would not be too great for the economical erection of heavy girders of spans from 100 feet or over. Taking into consideration the amount of metal to be erected in a short distance, it could be transported over a new line from one job to the next without taking apart and reassembling. In cases of this kind it would be economical and a very complete outfit, one which can be handled successfully on new work with better advantage than any traveler I know of. I find in the 23 years of experience I have had that no form of traveler will meet all requirements, but local conditions must be taken into consideration in many cases, especially design of structures, delivery of metal and location of work.

To illustrate this last statement: It became necessary to remodel the Portage Viaduct on the Buffalo Division of the Erie Railroad, and the work came under my supervision. It was necessary, in this case, to maintain traffic over this viaduct, it having gauntleted tracks. After due consideration of all points, more especially the fact that there are 100- and 118-foot spans between several towers, it was decided that the best form of traveler was a portable Howe truss. This I used by suspending bottom supports from the bottom of the Howe truss, forming an independent support for the new bridge during its erection. The intermediate spans I planned to erect with two square travelers with booms, one located at either end of short spans. This method I found very successful for these short spans. I enclose a general plan of the remodeled structure, which shows the location and lengths of the different spans.

The reason I have no plans of the different travelers is that each case was decided upon by making a pencil sketch of what we considered the best form. The travelers were built in the field by foreman in charge of erection, generally using some material on hand from other work.

The railroad company does its own erection of steel work, some spans over 200 feet.

If you wish any more sketches, for instance, of cantilever

traveler, I will try and furnish the same after meeting of Convention. I expect to be present at one session at least.

Yours truly,
W. H. WILKINSON,
Inspector of Bridges.

THE MISSOURI LINES OF THE CHICAGO, BURLINGTON & QUINCY RY. CO.

ST. LOUIS, MO., October 7, 1904.

Mr. G. W. Smith, 1247 Monadnock Block, Chicago, Ill.

DEAR SIR: In reply to yours of October 6. I am sorry to say that I cannot give you a report on travelers for erection of bridges. We have so-called travelers in use on our line but have no plans of them at all. We prefer, however, to use a derrick car for the erection of through spans and have been doing so recently. Our company erects its own bridge spans with its own men and equipment. I attach letter from Mr. Sheahan, our bridge superintendent, giving a very brief description of our use of it. I hope it will serve your purpose.

Yours truly,
L. F. GOODALE,
Eng'r M. of W.

BROOKFIELD, MO., October 11, 1904.

Mr. L. F. Goodale, Engineer, Maintenance of Way, St. Louis.

DEAR SIR: Regarding the attached about derrick car, will say that this is a very handy machine and would pay for itself in a short time on a line like the Burlington.

We found it very useful in our hurry-up job on the North River bridge, both in taking out the old iron and putting in the new. Of course in using a car of this kind (by putting in the floor system first), it is not necessary to have any travelers or upper falsework. At North River we picked up on shore the center piece of the top chord of the 148-foot span, and took it in and placed it on top of the posts. This piece was 73 feet long.

This derrick has been in use for some three or four years with J. C. Sheahan on the main line of the Burlington system through Iowa, Illinois and Nebraska, in erecting iron bridges and he can give you any information you desire about it. I think if I was ordering one I should have a car a little heavier than the present one.

Yours truly,
J. T. SHEAHAN.

THE MISSOURI PACIFIC RY. CO.

ATCHISON, KAN., October 8, 1904.

Mr. G. W. Smith, Chairman of Committee, Association of Railway Superintendents of Bridges and Buildings, to Report on Best Form of Traveler for Erecting Bridges up to 200-foot Spans, No. 1247 Monadnock Block, Chicago, Ill.

DEAR SIR: Your favor of October 6 received, and in reply will state that I am not prepared to report on such an important subject, but for your information and such use as you desire to make

of it will state that on the Missouri Pacific Railway the traveler that we have had the most success with has been of the kind most in use; one that would be high enough and straddle the span conveniently. The advantage of this style traveler is that the work can progress at all times without interfering with the passing trains, whereas, in the use of derrick cars, travelers of this kind have to move out of the way for every train, causing considerable loss of time, especially if the trains should be delayed and not arrive as per schedule. In addition to this it oftentimes becomes necessary to put in an extra switch and short spur-track to accommodate same. The services of the necessary conductor and brakeman add a still further expense. On roads where there is but very light traffic the derrick car in all probability has proved the most economical, but on many lines where you may have to contend with 50 to 100 trains per day there would be very little opportunity for a derrick car to be used.

Our company erects steel bridges with spans up to 200 feet with their own men and equipment.

Yours very truly,
F. W. Tanner,
General Foreman, B. & B.

The Lake Shore & Michigan Southern Ry. Co.

Cleveland, O., October 10, 1904.

Mr. G. W. Smith, 1247 Monadnock Block, Chicago, Ill.

Dear Sir: Answering your circular letter of October 6, relative to report of committee on best form of traveler to use in erecting steel railway bridges of spans up to 200 feet, will say that on the Lake Shore we have no standard form of traveler. We have no spans of 200 feet in length and only one bridge with spans longer than 150 feet. As we have no viaducts we have had no experience with the ordinary appliances for erecting viaducts. We use car derricks extending out in front of the car for our ordinary construction. Our bridges are principally plate girder spans and these we usually put in place with our steam derricks. As an instance of this I will mention that I am now placing some 103-foot spans of double track through plate girders, each girder of which weighs 146,000 pounds. These are handled by two derricks, one at each end, which take them off the cars, swing them around and lower them into place. It requires about 10 to 15 minutes to place them after the chains are adjusted on the girders.

In answer to your last question, will say that we erect all our own steel work.

Yours very truly,
R. H. Reid,
General Bridge Foreman.

DISCUSSION.

Mr. R. H. Reid.—We are using steam wreckers almost entirely and have about a dozen of them on the L. S. & M. S. Ry., ranging from 40 to 60 tons' capacity, most of

them being the 60-ton, and they will handle all kinds of steel girders. We have placed a 103-foot girder, which weighed 106,000 pounds, on the outside of a track next to that on which the derrick was standing and 19 ft. 6 in. away, and we have stood on one track and picked up a 64-foot deck girder bridge, weighing over 52,000 pounds from the next track, swung it around, carried it back and loaded it on cars without any outriggers. These derricks, as I stated, are the steam wreckers used for ordinary car or locomotive department wrecking, and I think, so far as my experience goes, that they are the cheapest method of erection that I have seen. They cost nothing, so far as the bridge department is concerned. We have to have them anyway and the only expense for the bridge department is when they are out on our work, and so far as I have checked up the average cost of erection of steel with these derricks, it would not average over $2 per ton.

We have erected a good deal of steel girder work, where the total cost, including placing the girder and time of bridge and trainmen, etc., is under $5 per ton. In fact, there is no case where it is over $5 per ton, where we have used these derricks. In the past two months we had occasion, in renewing our Ashtabula bridge, which we have been replacing with concrete, to lift with these derricks a 70-foot double-track truss span entire about two feet to put it into the position where we wanted it. We slid it over about 20 feet, uncoupled the lateral system, picked up one truss at a time and took out the entire 70-foot double-track span within nine hours from the time we took traffic off of it, and had everything clear. We took down a 155-foot double-track span, that weighed something like 400 tons, in six days and handled all the material with derricks. We had to put in false work in connection with the long span, but in the case of the short span we used none. The steam wrecker derrick cars, I think, are a good investment all around. The derrick cars, to which Mr. Smith refers, are, I suppose, the ones used in

regular bridge erection, which have a long boom extending out ahead. We have none of them on the Lake Shore for the reason that we have no work of the kind requiring them.

Mr. Smith.—In my report I intended to call the attention of the Association to the very full and valuable paper presented last season by Mr. Edinger of the Southern Pacific, which was published in last year's proceedings. That should be considered in connection with this subject.

Mr. Trippe.—I should like to ask Mr. Reid whether that $5 includes the riveting or just putting the span in place?

Mr. Reid.—Two dollars per ton is the cost of the train and derrick crew, which the motive power department assigns to the work. It does not include the labor of the bridge men. The $5 per ton includes the labor of the bridge men, riveting and all, complete, on plate girder erection, both deck and through spans.

Mr. Eggleston.—We erect our bridges in about the same manner as Mr. Reid describes. It seems that $2 per ton is pretty high for the motive department charge for use of derrick. Another thing; we do not use any chains. I have no confidence in chains in handling heavy work. We use stirrups, using 1¾-inch or 2-inch iron. I have recently erected some 95-foot deck spans, 9 feet 1 inch deep, in a peculiar place. We set the girders off and picked them up with a Bay City wrecking car of 50 tons' capacity, and set them in place in 20 to 25 minutes each. We erect all our bridges on the outside of old ones and never break traffic until we are ready to move the new bridge into place. It requires from 30 minutes to an hour and a half to make the change. In changing a bridge we roll the bridge out or in on steel rollers between the shoe and rails, using winches for power. The friction is reduced by using 2-inch rollers. The rollers out of old bridges are as good as anything for this purpose. We have handled our bridges, where I have been on the Erie road for a good many years,

in this manner and never have made a mishap, and the time occupied in breaking traffic is very little.

Mr. Steffens.—The subject seems to have expanded from the original one of the best form of travelers. If the discussion of derricks is open I think a good many members should be heard from, as every road probably erects more spans under 100 feet than over 100 feet. Referring to the use of stirrups, we have used both stirrups and hooks, but, as is usual with heavy girders, the question of security becomes an important one and then a stirrup is desirable. One span was erected on the West Shore of the New York Central road last February that was 116 feet long. Through plate girders were used, of which the central girder weighed 78 tons. It will be admitted that this is a heavy girder for length of span.

The West Shore Division of the New York Central is practically being rebuilt at the present time between New York and Buffalo. In that distance there are being replaced undoubtedly more bridges per mile than would be found under average conditions. In the work mentioned, the division wrecking derricks of from 40 to 60 tons' capacity are used. One span of through plate girders, recently erected near New York, at Weehawken, was 121 feet 6 inches long. Another span, as long as any on the system, is 128 feet long. All the above were erected with two steam derricks.

Turning to the original subject of travelers proper, indicated by the title of the paper; in dismantling the old bridges, many of which were truss bridges of the Phœnix column type, we have used travelers. The general form of one of these will be seen in the photograph illustrating erection work on the new Curwensville line of our road (see plates for Curwensville Viaduct erection), as well as in Fig. 6.

The most unique erection work that has been undertaken on the road in a number of years, or may be undertaken in the future, is on our Pennsylvania Division, west

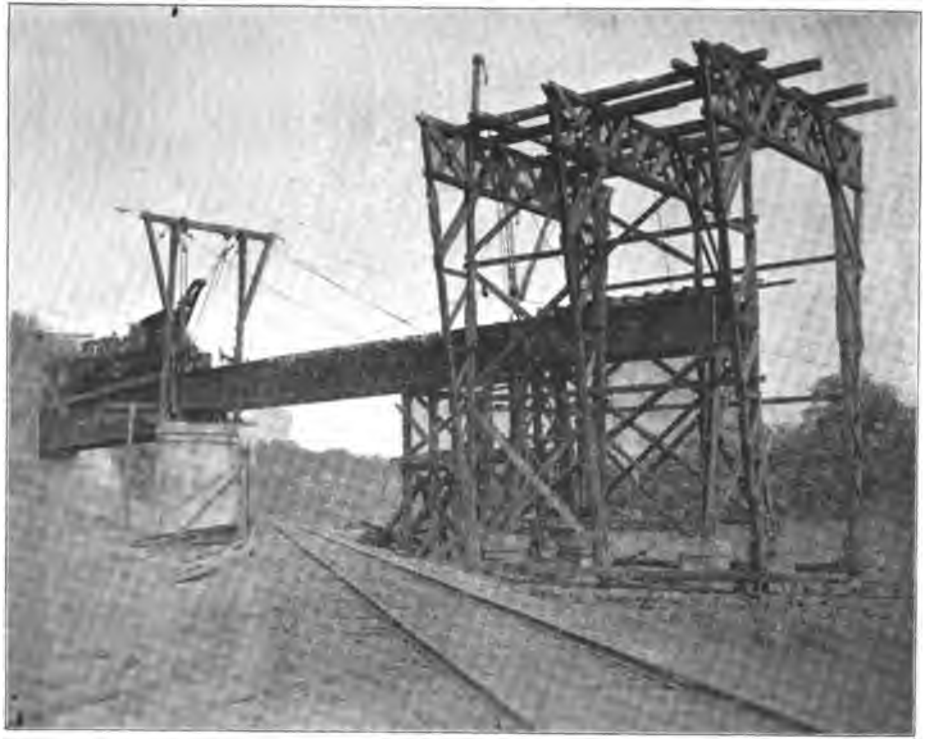


FIG. 5.—Curwensville Viaduct (N. Y. C. & H. R. R. R.). View Showing Erection of Span over Penna. R. R. Track, Using Gallows Frame at One End and Traveler at the Other.

Fig. 6.—Type of Two-Bent Traveler Used in Steel Erection Work on the N. Y. C. & H. R. R. R.

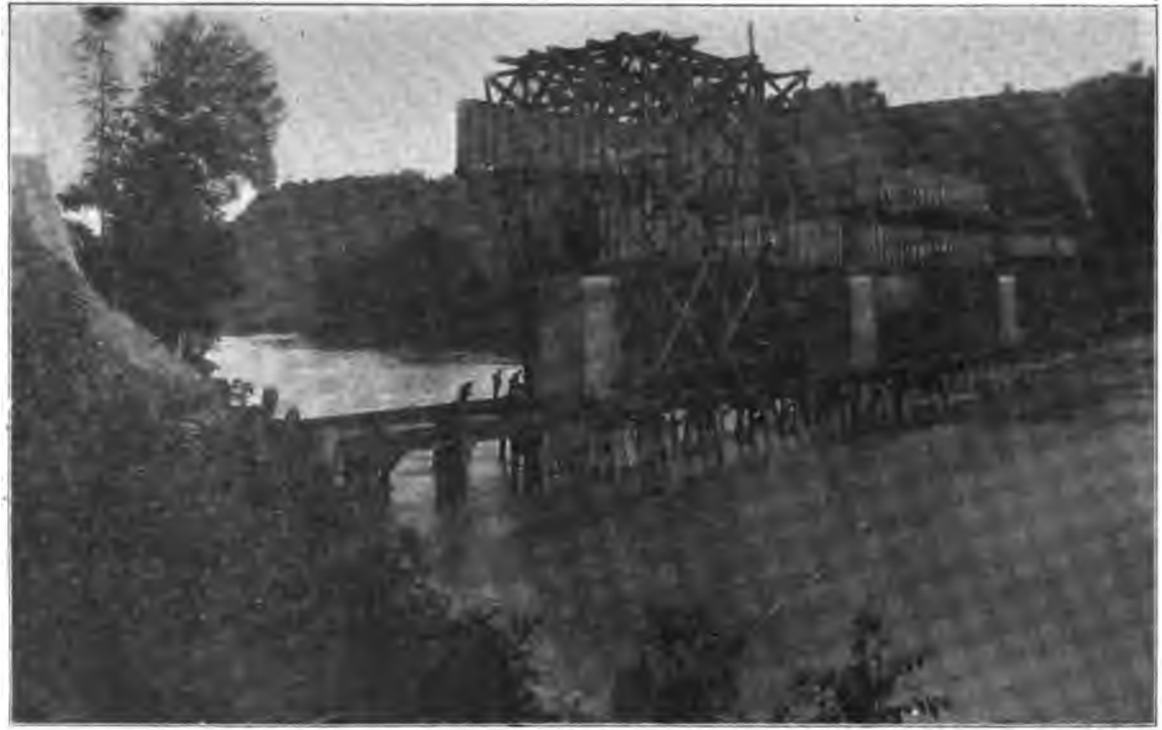


FIG. 7.—Curwensville Viaduct (N. Y. C. & H. R. R. R.). The 100-foot Girders Being Carried into Place by the Traveler. June, 1904.

FIG. 8.—Curwensville Viaduct (N. Y. C. & H. R. R. R.). The 100-foot Girders Being Carried into Place by the Traveler. June, 1904.

FIG. 9.—Curwensville Viaduct (N. Y. C. & H. R. R. R.). The 100-foot Girders Being Carried into Place by the Traveler. June, 1904.

of Jersey shore, where the Susquehanna River is crossed by five truss spans, 170 feet long. The trusses are 32 feet deep. The floor system is nearly midway between the chords. Between the old piers new piers have been built with the object of replacing the truss bridge construction with deck plate girders. This division is also being double-tracked at this point.

Owing to the height of the road above the river it was thought advisable and economical to place the new spans, if possible, without false work. For this purpose a movable platform or trolley traveler was built to run on a track placed on the top chords of the truss spans. The platform was so designed that the hoisting timbers or floor joists of the platform overhung the bridge, so that their outer ends were considerably beyond the center of temporary position for outside girders of the second track. (See Fig. No. 10. To place the first span the traveler was brought as close to the east abutment as possible. The first girder was placed on a car overhanging nearly half its length, so that the falls from the traveler could be attached to its outer end. The in-shore end was then supported by a steam crane and the car withdrawn. The traveler and the derrick car then moved forward simultaneously, carrying the girder out to proper position. (See Fig. No. 11.) The outside girder of the first span was carried out similarly, hanging close to the trusses. When opposite its correct position, shores were placed under the hoisting timbers and wedged upon the girder first placed, so as to relieve the outside truss of a portion of its load. The girder was then transferred to a second set of falls placed on the outer ends of the hoisting timbers, from which it was then lowered into proper position. (See Fig. No. 12.) After the cross frames and laterals were bolted in, track was laid on this span and the girders for the next span brought up, carried out by the traveler, acting this time without the assistance of the derrick car. This operation was repeated for all of the deck spans, ten

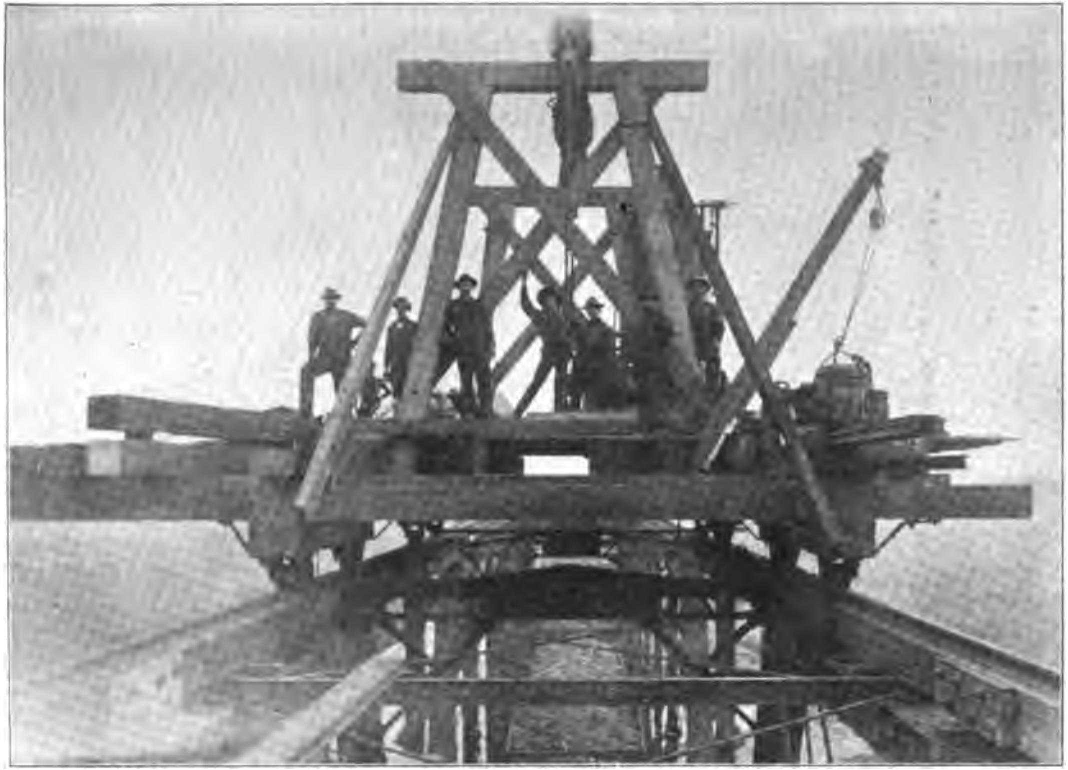


FIG. 10.—Bridge over Susquehanna River, near Oak Grove, Pa. (N. Y. C. & H. R. R. R.) Trolley Traveler (before completion) for Erecting Girders for New Second Track. September, 1904.

FIG. 11.—Bridge over Susquehanna River, near Oak Grove, Pa. (N. Y. C. & H. R. R. R.) Trolley Traveler and Steam Crane Carrying out First Girder of New Second Track. September, 1904.

FIG. 12.—Bridge over Susquehanna River, near Oak Grove, Pa. (N. Y. C. & H. R. R. R.) View Showing Rigging of Trolley Traveler for Erecting Girders for New Second Track. September, 1904.

in number. The cost of erecting these spans by the method outlined will be considerably less than if false work had been used in the usual manner.

After all the girders for the northerly span had been placed, traffic was transferred to that track. The truss spans were replaced as follows:

The west span of girders riveted up complete was carried out on the old track. It was then lifted sufficiently to clear the cars and supported temporarily on pony bents, resting on the piers. The old floor system was then removed and the girders lowered into place. To take down the trusses a form of inside traveler was used. The old truss spans were supported by placing ties at panel points sufficiently long to clasp the posts. Short braces were run from the outer ends of these ties to the bottom flanges of the girder to prevent overstraining the ties. To support the top chord and wedge up the bridge to take out camber prior to dismantling, shores were placed on the long ties mentioned and supported at the bottom by proper wedges. A framework was placed at each panel point, extending below and supported by the new girders. Planks placed on these served as platforms from which the bottom-chord bars could be dismantled.

President.—In reference to the remark made by Mr. Steffens that the subject of derrick cars is a little out of place, he is correct, but the committee decided—and I think very justly—that as this report covered the erection of spans up to 200 feet, it was very proper to bring this point into discussion. Now that this question is open, we would be glad to have any one else give their experience.

Mr. Killam.—I can say that during the last two years we have remodeled or erected some 125 steel spans, either by doubling up where they were single spans or by putting in four girders where there were but two. There were three classes of spans: the 66-foot spans were 6 feet 7 inches deep; the 88-foot spans were 7 feet 8 inches deep and the 109-foot spans were 9 feet 10 inches deep. In

no case in erecting these spans did we break traffic any time. The spans were placed so that they were picked up by the derrick car, one swung at each end and carried out by the derrick and dropped over the side and put in place. We erected in that way one bridge of these spans, that was 86 feet high, no temporary work being used. We erected about 101 of this class of spans. Some of the members present saw some of them. It usually took about two hours to put one of them in place. We finished one a few days ago of five spans of 200 feet. In none of these cases was traffic broken. We have had to spend some $2,000,000 on new bridges and doubling up old latticed girder spans because they were of the old English type of lattice truss bridge of depth one eleventh of the span, and too light for the present heavy locomotives. In no case have we broken traffic. It occupied about two hours to run out and put a span in place. When we came to put in new tracks, traffic had to be broken, but I do not think a train has been stopped over two hours.

Mr. Richey.—I would like to ask what kind of a traveler would be used in putting in a 60-foot span between towers in the erection of steel trestle or tower construction?

Mr. Smith.—I will say that in the replies received from the members the cantilever traveler is mentioned as being suited to that work, and is what you might call a trolley boom. It can be arranged to set the towers and girders as well. There is a special arrangement that has been used. I do not know that I can recommend it as desirable for all occasions. It has been used with good results in the case of viaducts. At the working end is erected a tower, which passes under a cable, and the traveler runs forward on the cable. The operating part of that traveler is two booms set just above the level of the rails, the width of the traveler being such that it travels on the ends of the ties. The purpose of the design was simply to furnish a device which would enable the setting of the towers in advance.

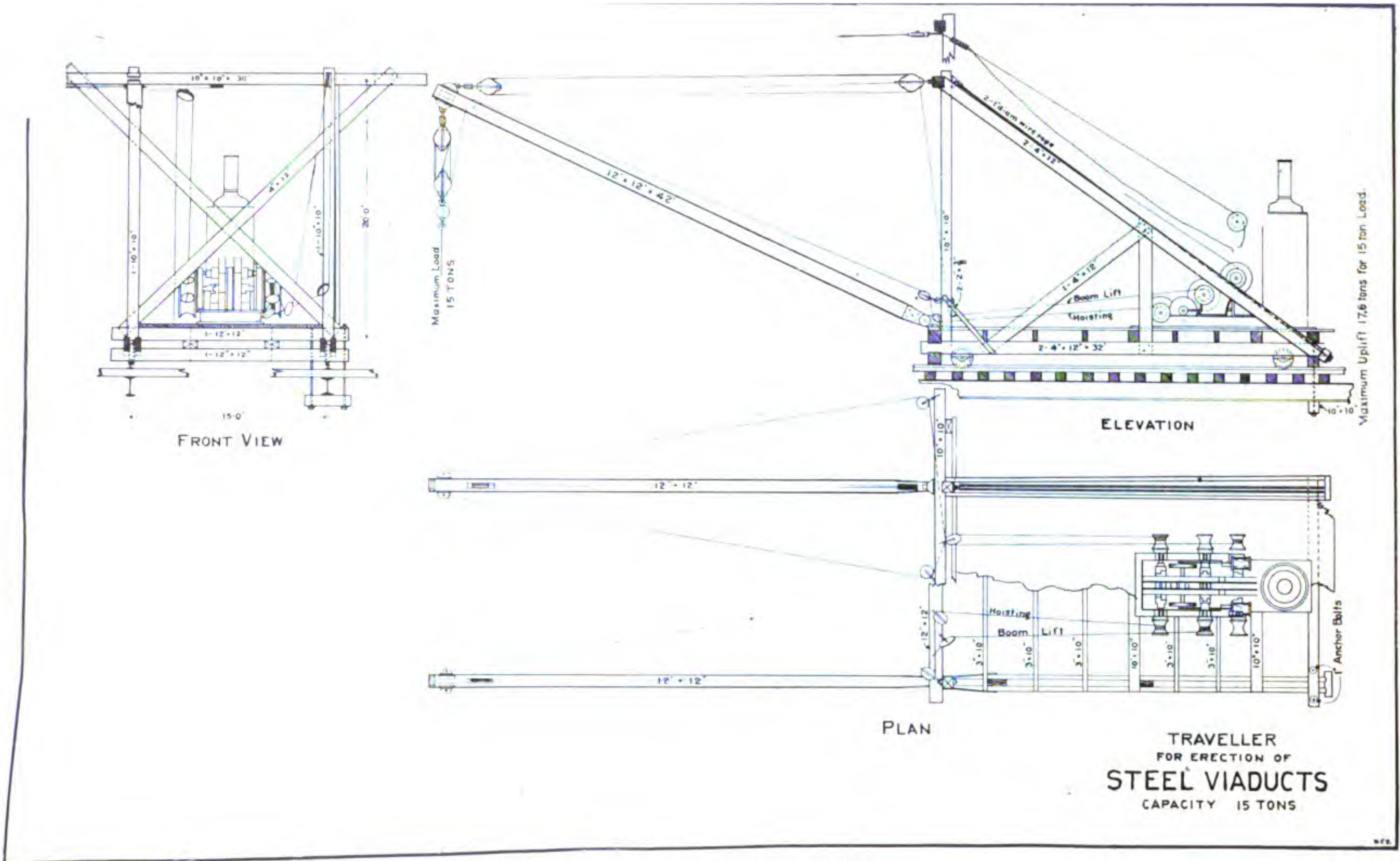


FIG. 13.—Derrick Traveler for Erecting Viaducts.

Mr. Steffens.—In answer to the same inquiry will say that I will hand the secretary a sketch showing the form of traveler similar to the one just described. This form applies particularly to the erection of viaducts and of elevated railroad structures in cities.

On our Pennsylvania division, in connection with the construction of a new line, the Susquehanna River is crossed by a deck-plate girder-structure of three (3) spans, each of which is 85 feet long. False work of only sufficient strength to carry cars was erected. Then by means of gallows frames erected at the ends of the first span the girders were swung from the car into position. Photograph, showing general features of such a gallows frame, will be published in the proceedings in connection with the description of the Curwensville work. (See Fig. 5.)

On another part of the same new line, at Curwensville, a viaduct of a total length of about 850 feet, part of which is on tangent and the remainder on a 10-degree curve, was erected. For two spans, 105 feet and 92 feet long, light false work and the gallows frames were used similarly to the above. For erecting the remainder of the structure, which was typical viaduct construction, consisting of tower spans of 30 feet length and main spans of about 60 feet length and three 100-foot spans for the river crossing, low cribbing was used to support a track just outside of the masonry piers. Supported on this cribbing and straddling the entire structure, with sufficient head room for cars containing girders, a three-bent traveler was erected. The girders and other material were picked up by this traveler and carried out bodily into place by pulling the traveler ahead. Typical photographs, illustrating the work will be published in the proceedings.

Mr. C. W. Richey.—We have placed numerous plate girder spans on this division with the use of our steam wrecking derricks, but I have never used a regular derrick car built especially for bridge erection. The last bridge erected on this division consisted of three spans of 120-

foot plate girders weighing approximately 50 tons each. These girders were placed along side of an existing bridge to make double track and in placing them we used two steam wrecking derricks very successfully.

During the elevation of the P., F. W. & C. tracks through the city of Allegheny a derrick car, built expressly for the erection of steel work, was successfully used in the erection of plate girder spans and steel viaducts, the work of this car being very rapid and economical.

At Aspinwall, on our new Brilliant branch, there is a double-track steel viaduct of 600 feet in length in course of erection and a derrick car is being used for this work.

I will say that for erection of steel viaducts, plate girder spans and short truss spans, I am very much in favor of the derrick car for erection. In the renewal of an existing truss bridge the use of a derrick car could not be worked successfully on account of disturbances due to trains and would hardly favor its use for this purpose. I would rather use the old frame traveler.

Mr. C. W. Kelly.—I would like to ask Mr. Reid in relation to his cost of $5 in handling these bridges, if that was for bridges on single track or if he could set the span on another track and pick it up afterwards.

Mr. R. H. Reid.—This case that I spoke of was on double tracks. Our main line is all double-tracked and part of it four-tracked, and in replacing girders we set the empty cars on one track and pick the girders out of the track, place them on cars and shove them out of the way, and bring the cars in with the new girders on. We took out five spans of girders, total length about 200 feet, and put in five new spans, and had trains running over it the same afternoon. That was on our Buffalo Division, where we have from 150 to 200 trains per day and we had to keep them moving.

Mr. Schall.—I would like to suggest that it would be a good idea to continue this committee, have it present typical plans for erection of different kinds of bridges and bring out the subject a little more fully.

President.—Mr. Smith, will you please pass the blue prints and photographs which you have around, so that the members can see the various forms of construction.

Mr. Smith.—They are not as broad in scope as I should like to offer. Personally, without regard to the committee report, I am enthusiastic in the use of derrick cars. I believe that for all bridges under 200 feet in length the derrick car is the best. I think that this is a subject that we are all very much interested in and one in which we will become even more interested, as railway companies will erect more and more of their own bridges. Consequently I should like to have the committee on subjects for next year include this question.

President.—Mr. Killam is on the committee of subjects for next year. I will ask him to have something suggested on that line and I think we ought to reach a conclusion as to what is best to use.

Mr. Killam.—I would say that I consider your suggestion a good one as it will enable the committee not only to consult with the different railroad authorities but also with the companies that erect bridges, and collect information on the subject.

Mr. Burrell.—I have heard all this discussion about the replacing of bridges but I have not heard anything about the best form of traveler to be used in construction work at the front. Is there any better form of traveler than that used in reconstruction for this class of work?

Mr. Steffens.—Mr. Burrell's question has been answered already. Much of the work that has been described is applicable to new work as well as replacing. The viaduct that I spoke of with low false work is all new work. The method of erection of viaducts applies also to new work, no false work being required where overhanging booms are used.

Mr. Alexander.—Our road has had its bridges erected by bridge companies and we have not erected bridges of more than 75-foot girders ourselves, and these we erected

with two bents. The discussion should be based on a certain length of span. Our road can handle girders with derricks very well. There is a great difference, however, between handling girder spans and long truss spans. A steam derrick will handle small bridges very cheaply, but the traveler will handle the truss bridge without the great expense for false work to carry the derrick car, and we have had it used on our road successfully. The use of one or the other depends on circumstances. In many cases I think the traveler does its work well. We had a large truss bridge erected on a new road without false work. It was about 60 feet above the water. One long span was raised on the shore and was attached to the next span by heavy links. The traveler was erected on top as it was a deck bridge pin-connected with stiff bottom and top chords. Each span was erected in the same way. It was done very successfully.

Mr. Penwell.—We put in seven trestles, the highest one of which was 130 feet; the spans measured about 85 feet, the towers 32 feet. These girders were put in with a traveler on top. I do not think we ever held a freight train 30 minutes. There are two conditions to be considered: when you have an old bridge to work on and when you put in a new one.

Mr. Steffens.—The remarks of the preceding speaker reminded me of an experience on our road recently. It is quite a different matter to erect a traveler on the deck of a deck truss bridge high above the water level than where a through truss bridge already exists, which can be used in erecting the traveler. In replacing at Croton Lake three deck spans with one through truss span, 384 feet long, this summer, a traveler of total height, nearly 80 feet, was put up under these conditions. The photograph (see Fig. 14) shows the method of erecting the first bent of this traveler by means of a trip bent.

Perhaps the interpretation of the title of this subject can be extended to include the rebuilding of a long pile

FIG. 14.—Erecting Foot Bent for Croton Lake Bridge (N. Y. C. & H. R. R. R.), by means of a 40-foot Trip Bent. August, 1904.

trestle. In rebuilding such a structure on the River Division of the West Shore, where the depth of mud rendered necessary the use of piles 85 feet long, it was necessary to employ a special method in order that traffic should not be seriously interfered with. To obtain this result we built a traveler straddling the entire structure and placed on the platform on top of this a pile driver with leads extending down nearly to the level of the track. To date the method has been very successful.

Additional written discussion on subject, No. 1, by Mr. J. P. Snow, Bridge Engineer, B. & M. R. R.:

The Boston & Maine Railroad do not erect their bridges as a general rule. Small through bridges and nearly all deck girders are erected by the railroad men, but truss bridges of magnitude are erected by the builders.

Considering the subject by the three divisions named by the committee, girder spans can best be put in, I think, with derrick cars. Through girders can often be built alongside the site and slid into place between trains, Sundays being generally the most favorable for such work. Derrick cars in this case are very convenient for clearing out the track and old bridge.

In case of deck bridges I prefer to have them riveted up complete, when they can be put in place quite readily by means of a gallows frame at one end and a pile driver at the other. A derrick car is of course preferable to a pile driver if powerful enough to lift one end of the complete span. If such a derrick car is not available a good car pile driver can be made to serve. The leaders should be blocked up on the parapet, a lashing put on the leaders high enough to carry a tackle to raise the bridge from the car and the other end raised by a gallows frame. When raised, the car is run out under the gallows frame, the track removed and old bridge slid out or tumbled down, and the new girders lowered to place. This work can, of course, be done with jacks, but it is slow.

A gallows frame at each end is an excellent rig for

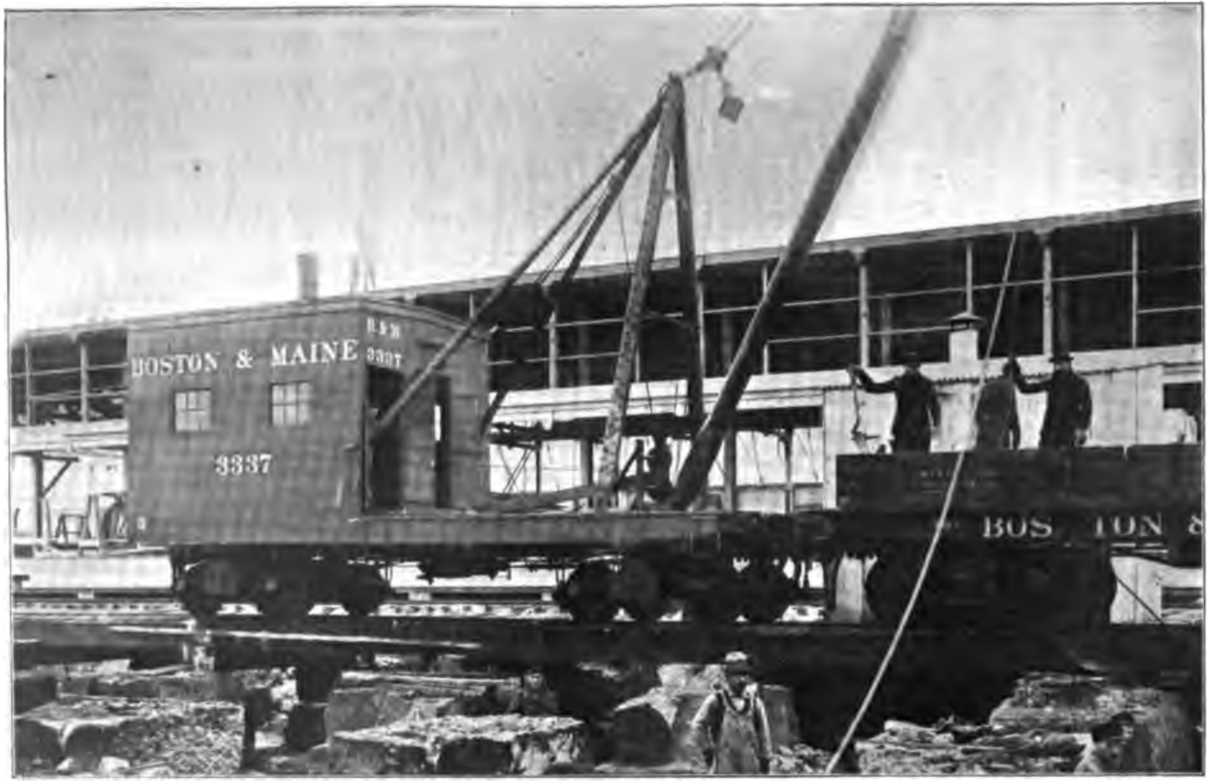


Fig. 15.—Derrick Car, Boston & Maine R. R.

The Boston & Maine derrick car shown above is designed for general railroad use rather than for erecting bridges. It is good for eight to ten tons, depending on the boom. Its peculiarity is that the A frame or mast is capable of being quickly lowered for transportation. A secondary hitch will be seen about half way from the foot of mast to cabin. This is to receive the foot of frame when the peak is lowered. The fall attached to head of frame is used for raising and lowering the peak. When in the lowered position there is nothing higher than the roof of cabin. The boom is of course lowered to a rest on the car ahead and the A frame is self supporting in its lowered position. These cars are self-propelling, although the gear does not show on the one photographed.

putting in small bridges, making in fact a stationary traveler.

For viaducts I prefer an overhanging traveler which is arranged to receive the material from the rear and trolley it forward to the end of the boom. This requirement necessitates a complicated and expensive traveler, but if the viaduct is high and ground rough I believe it will pay.

Where the ground is such that the material can be distributed under its final position, a simpler traveler can be used. This applies to new lines. For renewing viaducts on existing lines such a traveler is not feasible.

For ordinary truss bridges I think the common traveler on flanged wheels running on rails is better than derrick cars, although both combined, the traveler for holding the incompleted trusses up and the car for bringing in parts and hoisting to place, are better than either separate.

Traveler legs may well be made of latticed angles, in which case they admit of easy extension for varying heights.

For bridges of many spans it is necessary to move the engine to a support at a pier unless it is carried with the traveler, but for ordinary cases it would seem hardly advisable to encumber the traveler with the engine. When electric hoisters are used instead of steam, perhaps they may be carried on the traveler.

The derrick cars, referred to above, are supposed to be self-propelling. If not so rigged they do not deserve to be considered as suitable tools for erecting bridges.

II.—What Has Been the Experience in the Use of Concrete Under Bridge Bed Plates and Turn-Tables in Place of Pedestal Stones, and What is the Best Form of Material for Bed Plates Under Various Styles of Iron Bridges?

REPORT OF COMMITTEE.

The chairman of this committee has been too busy with routine duties to take the matter up with the balance of the committee in time to present a report signed by the other members of the committee, but submits the following, hoping that it may be better than no report.

Mr. A. S. Markley, Division Engineer of the C. & E. I. Railway, has volunteered the following:

"Our experience with concrete has been attended with nothing but the very best results. We have 100-foot spans resting on concrete same as piers are made of, which has been running for the past four years, and there is no indication whatever of wearing into the concrete at the bearings. We have them also under center of turn-table where we turn our largest engines, the weight of the engine and table having been put on the center 18 hours after the concrete had been put in place with no visible signs of settling in any direction after two years' trial."

The writer's practice for a number of years past has been to make concrete bridge seats for the support of superstructures on all concrete abutments and piers. This has also been the practice on the road, with which the writer is connected, for a number of years, and the experience so far indicates that concrete is in every way as suitable as stone bridge seats, if not better. Wherever it is necessary to repair old stone masonry, or cut it down for deeper structures, we almost invariably put on a concrete coping or bridge seat, as it is cheaper to put in, bonds the old masonry better and gives a better distribution of the weight of the structure. The writer's observation is that the practice above stated is quite general. He has found no occasion to even limit the size and weight of the superstructure on concrete bridge seats.

It is considered essential that the concrete for bridge seats and coping should be of first-class Portland cement concrete.

It is probable that a great many engineers are allowing a higher unit pressure on bed plates resting on concrete than on limestone and sandstone masonry, and the writer believes that this practice is fully justified.*

As to the best form and material for bed plates of metal bridges, the writer's preference is, first, for iron or steel casting and, second, for built-up bed or wall plates, designed so as to distribute the weight equally over the entire bearing and made high enough so as to bring the rollers and bolsters above the bridge seats, where they will be better preserved, especially the rollers. This applies to all types of metal bridges.

Respectfully submitted,

C. F. Loweth,
Chairman.

* This statement is one open to question.—Ed.

DISCUSSION.

Mr. Reid.—It seems to me that the use of concrete is increasing rapidly and I think it is only a matter of time when nearly all the railroads will get into the general use of it. We have gone into it on the Lake Shore during the past year more than ever before. We have stone all around us and yet we are using from 35,000 to 50,000 yards of concrete this year.

Mr. Penwell.—We have been using concrete almost exclusively for the past two years and I would be glad to have this subject carried over and made a special subject for next year. We used granite concrete as a test in one case for bridge seats and I have been watching it very carefully. So far all our other concrete has been made of limestone and it has proven very satisfactory. We have only this one particular job made of granite and I would not want to recommend that, however, unless it is found to be a good thing. I will keep a careful watch on this and be glad to report at the next convention and give you the result of my experience on this.

Mr. Steffens.—This is one of the subjects where the engineering department can help out the bridge and buildings department. If the bed plates are given sufficient area and the unit stress on the concrete is not too high, I do not think there is any question but that concrete is as good as stone. A unit pressure per square inch of 250 pounds is called for in specifications, but on the New York Central that has been reduced to 200 pounds. We are great concrete users, no stone whatever being employed now. Of all the bridges put in during the program of strengthening during the last five or six years there has been no crushing of concrete, using the unit values for stresses noted. Concrete, of course, must be richer for bearings than for use in other places. The proportions used on the New York Central are one, one and two. In concrete bearing courses we use a 3 x 8 mesh netting with 8 and 10-gauge wires electrically welded. The results have

been uniformly satisfactory. In locations where old masonry is utilized and alterations made to bridge seats, using concrete on top of the old stone, it is our practice to put rails in the concrete. There have been no failures thus far and we have no cracked masonry.

President.—You say that you had no failures in the last five or six years since you used the unit stress of 200 pounds per square inch. Did you have any previous to that?

Mr. Steffens.—Concrete has been used only during the present administration.

Mr. Alexander.—I have had a little to do with this question of turn-table foundations. At first we had some failures. In some places where poor concrete was used the frost got hold of it, but we rebuilt with good concrete and it is all right. We have taken out turn-tables where the foundations had gone to pieces where the concrete was poor and the moisture and frost got down into it and cracked it all to pieces. We took out the turn-tables and built concrete pedestals and put in cross-laid rails in the concrete and put the pedestal on top of the rail. In this way, when our concrete was made and the turn-tables placed and ready to use, we could use them without any bad results because they were standing on iron which reinforced the concrete until thoroughly set. We have built two of them in that way successfully.

Mr. G. W. Andrews.—Concrete, like all other things, has a great many failures. This is due in some cases to the men who mix it not putting in the amounts or proportions called for in the specifications. The greatest cause of failures, I am confident, is due to the fact that nearly always we have an idea that concrete can be mixed by an ordinary laborer. That is true in one sense, but an ordinary laborer should have a skilled man to show him how concrete should be made. Moreover we have gone ahead and mixed concrete with anything from gravel of ½ inch to boulders of 8 inches diameter. If you mix concrete in good proportions and allow it to set before it is

loaded, you can get good results, but you cannot expect anything from concrete unless it is mixed in good proportions and by men of experience.

Mr. R. H. Reid.—We have had very good success with our concrete and use it for general work. We use a proportion of one of cement, three of gravel and six of broken stone—crushed limestone. The concrete that we get from that sets as fast as we can take care of it and it is very hard and firm, much harder than any sandstone and, I think, than limestone, but is not so brittle as limestone. I do not think there is any comparison between this concrete and the very best of limestone, as the limestone masonry goes to pieces very rapidly. I do not know of a case anywhere on the road where we have had a failure with concrete. This morning, at Elkhart, I was looking at a center pier under an 85-foot turn-table, which shows our confidence in concrete. I was also looking at some arches there that we put in a year ago and they are in perfect condition. A short time ago when we took out the Ashtabula Bridge, I was examining the concrete bearings that we put in four years ago and they were in perfect condition. There was not a crack in them. They were very hard and came out as a solid block. In many cases, where stones were taken out, they broke up, but the concrete came out in single pieces. Good concrete, if properly placed, is better than 75 per cent. of the masonry. I do not think there is anything better unless possibly first-class cut stone.

Mr. Killam.—When our lines were constructed there was no concrete used. However, after a period of years light masonry will shake to pieces and we have replaced a good many small culverts with concrete, which stands well. We have replaced some bridge seats with concrete. A large portion of the bridge seats, however, are of granite. Some of our viaducts have stone, four feet square, on top and 14 inches thick under the columns, and we took them out and put in concrete instead. In going over the road I noticed two or three abutments that had been in 40 years

or more and were beginning to crack. We are building a concrete wall around them, and have put an angle plate in the bank and wrapped wire netting around it and then floated concrete in it. All our concrete work is done by two or three experienced men, the material is furnished by the department, and in no case have I found defective concrete work from one end of the road to the other, except, as before stated, where salt water is. In one case it was affected by salt water, but fresh water does not seem to have any effect on it. The piers of one bridge that I know of have the corners eaten off by the salt water. The solidity of concrete I saw tested at a place where we have large chutes set in with concrete columns in which the engineering department called upon us to cut holes, and I saw two men work two days going 14 inches into this, so you can get an idea of the solidity of this concrete. Concrete, so far as we have used it, has proved a most excellent thing. We use sand mixed with granite and clean as water can wash it, which makes good concrete.

Mr. Steffens.—We are wandering away from the subject. The wearing away of the corners that Mr. Killam speaks of I imagine is due to the action of ice or drift. That reminds me of the method of reinforcing the corners of concrete work on our system. We use a rail on a corner wherever an angle is turned. It is thoroughly bonded back into the concrete by means of bolts, drilling holes large enough in the web or flange of the rail to admit them.

Mr. J. F. Parker.—I understood Mr. Killam to say that salt water has a bad effect on concrete. Now at San Diego Bay we have a wharf with about 2,000 piles in it, and the only protection we have found to prevent their destruction by the Toredo and Limoria is to cover them with a cement jacket from the mud up to the high water mark. The depth of water is from 30 to 40 feet. The concrete is made of one part cement and two parts of fine sand. This stands the action of salt water there

and the water is very salt, so much so that salt is made there quite extensively by separating the salt from the water by evaporation.

Mr. Killam.—These conclusions that I arrived at were only from my own observation. In fresh water I find no indication of decay in concrete, but in salt water I do. I have found some failures.

Mr. Bailey.—In winter time we use salt in the mixture to prevent freezing, and so far it works all right. As regards our experience with turn-tables, the mixture we use is 1, 2½ and 4½. In one case we had to take out concrete where the drainage was bad and had to use powder to get it out, as there was no other way of breaking it with that mixture. Wherever it broke, it broke the stones in it. As far as my experience goes, you can put any pressure on that mixture.

Mr. Steffens.—The point just brought out calls for an answer. The addition of salt to water for mixing concrete in winter has been thoroughly discussed by the engineering fraternity. The celebrated French authority on concrete, Candlot, has demonstrated that salt in moderate quantities is not harmful to concrete.

The preferable method for handling concrete work in winter is to heat the materials. The stone and sand can be heated by placing them on steam coils, steam for which can be supplied from the hoisting engine on the work. One decided point in favor of this method over that of burning refuse material on the heaps of sand or stone is that the night watchman can keep just enough steam passing through the coils so that by the time the men begin work in the morning the materials are warm and no time is lost.

An additional aid is to build the forms for the work double, leaving at least six inches clear between the walls, which space can be packed with manure. Many bridges have been replaced on this system in winter, where conditions demanded completion of the work, and we have never

had any frozen concrete. This point may be especially applicable to the question of concrete work for turn-tables.

Mr. Burrell.—I have heard no one speak on the price, the cost of the labor and material. I would like to hear from some one on this subject; also of the various kinds of cement used, and the results.

Mr. Schall.—That is a different subject. The subject now under consideration is concrete under bridge bed-plates. Of course, I suppose Mr. Burrell would say that he wanted to know what it would cost to use cement under turn-table bearings.

Mr. Burrell.—It seems to me that it is a very important question as to whether it would cost more than masonry. I have put concrete under one or two turn-tables with good results and it is still in good condition. This cost for labor of unloading, mixing and placing, including the excavation of the site, was from 83 cents to $1.25 per cubic yard, while the labor for the same amount of work on masonry has cost me from $3 to $5.25. I use a mixture of 1 cement, 2 sand and 4 limestone and, as yet, I have seen no indications of failure. I also have two or three bridges with abutments which are solid concrete from top to bottom cf foundation, put in about four years ago, and show no signs of check or cracks from any cause.

Mr. Bailey.—On our road masonry costs about $7 per yard.

Mr. Steffens.—The stone in that class of concrete of which I spoke, the 1, 1 and 2 concrete, is about ½-inch diameter. We are going to put this concrete under an 80-foot turn-table, simply reinforcing it with rails.

Mr. Killam.—I would say as regards price, if you confine it to the question before the committee of concrete under bridge seats, the item is so small that it cannot be computed by the yard. It is largely a question of getting the material to the place and putting it in. It costs from about $6 to $7.25 per yard.

Mr. Burrell.—I wish to say in regard to the engineering department, then in charge (in 1900 and 1901), that the

engineer in charge was not thoroughly familiar with cement work and the handling of concrete.

The specification was 1, 2 and 5. I showed a sample of the result of this mixture and suggested 1, 2 and 4, which was allowed.

In the mixing of the concrete I added just enough water to make a plastic mass of the cement and sand, such a mixture as would hold its form when pressed in the hand. This mortar was spread out and the necessary amount of stone was added by spreading them over the mortar and thoroughly mixing until no dry stone appeared in the mass.

A little water should be added while mixing the stone, as the stone absorbs the moisture. This mixture was then placed in the forms and tamped with an 80-pound tamper, and the work shows for itself today.

Mr. Steffens.—Referring to the question of stones absorbing water, the remedy is to dampen the stone before using it. In regard to Mr. Burrell's difficulty with the engineering department, whenever you are in doubt about such matters ask your neighbor. I never yet have sent out a circular to which I have not received some reply. If my friends write to me I am only too glad to give them what information I can.

Mr. Alexander.—I think perhaps I gave the impression that we did some very poor work. We did. A local engineer or person in charge had liberty to do the work and he did it that way. The two cases that I cited were failures, but they were not all failures, and we are building good concrete and lots of it. We use it for bridge bearings and have never had a failure of bridge bearings. We do not take the pains that some of you do. We take clean gravel and make concrete of it without any trouble. We have also used a good deal of broken stone. We had some young engineers who did their work in a hurry, but we are now doing some very good work.

Mr. Burrell.—The point that I want to make now may not be very close to the subject, but in the organization of your forces it is absolutely necessary that you get an in-

telligent man as foreman, who will watch the men under him closely and see that the work is properly done in every stage. This is a class of work that is open to many excuses and for that reason you must be sure of your foreman.

Mr. Sheldon.—I think there are many of us who have noted results of the action of salt water on concrete similar to those of Mr. Killam, finding that fresh water appears to do much less damage to concrete than salt water in a given time, under similar conditions.

Mr. Steffens.—One member said that the use of concrete or stone under turn-tables might be determined by local conditions; that if it were necessary to apply the load immediately, it would be best to use stone, as concrete must be allowed to set.

Mr. Penwell.—We have overcome that largely by making a concrete block about two feet thick and having it ready to set in the concrete bed. In this way we get a larger bearing than we otherwise would and it has been very successful.

President.—This subject has been pretty thoroughly discussed and I think it has brought out the fact that concrete under bed plates and turn-table piers is proper to use and that you can get good results from it, when it is put in the way it should be, proper mixture made and supervision given the work. That practically settles this subject and I think we can proceed to the next subject.

Mr. Richey.—I would like to ask what good concrete is.

President.—We had a report on concrete about three years ago, made by Mr. Rogers, filling about 60 pages in our proceedings and giving all methods of mixing concrete, the proportions of cement, sand, etc. I think the conclusion of that committee was that a moderately moist mixture was best; at any rate, better than a mixture that was dry. If you will go back to that copy of our proceedings you will find a very complete report on that subject.

III.—Best Methods of Caring for Trestles while being Filled.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

Gentlemen: Your committee selected to report on Subject No. 3, viz.: "Best Methods of Caring for Trestles while being Filled," beg to submit the following report:

The following list of questions was prepared and submitted:

No. 1. Is the practice of filling in trestles one that is common on the railroad you are associated with?

No. 2. Have you ever experienced any difficulty by reason of vertical pressure on horizontal timbers or lateral pressure on or against vertical timbers or posts during process of filling?

No. 3. Do you consider it necessary to take precautions against injury to trestles by reinforcing before commencing to fill, and if so what is usual practice?

No. 4. What general rule would you follow in filling in trestle bridges to prevent crowding of bents laterally? Would you work from one end, or would you keep dirt or filling matter of uniform height throughout?

No. 5. What portions of the bridge structure do you remove, and what parts do you allow to remain in the filling?

No. 6. If the removal of stringers from filled-in bridges has been delayed until near the approach of winter, is it safe and common practice to remove them at such time?

No. 7. Is it your opinion personally that deep fills should be made quickly and timbers removed therefrom as soon as practicable, or allowed to stand and settle before removing them?

No. 8. Would you fill what was practicable from below, or is it preferable to do it all from on top?

Your committee has endeavored to examine into this subject carefully, and while a settled plan of action could not be adopted for all conditions these general rules will apply. Some of the replies we will here reproduce as deserving of especial mention on account of the volume of work performed of this nature by the parties making the report, and the success which has attended their work makes the report of certain value.

The following is from Mr. F. Ingalls of the N. P. Railway and of this committee: "On my division, while we have done a

large amount of filling, there have been but two of any size, one a pile trestle 2,000 feet long across a lake, which was filled from the top of bridge by train, the water being about 12 feet deep and the top of tie about 6 feet above the water. In filling some of these piles were crowded out from under the caps but not enough to materially affect the safety of the structure. The other was a trestle 80 feet high and 1,500 feet long, with frame bents set on pile foundations. In filling this trestle a temporary track was laid on each side of the bridge and the filling carried up to within 20 feet of the top of the bridge, both sides being carried up as evenly as possible. It was then allowed to stand for about two years, when the balance was filled up with work train from the top of bridge. On account of the care taken in filling we experienced no difficulty by reason of vertical pressure on the horizontal timbers or lateral crowding against the vertical timbers during the process of filling. In both cases (in the bridge across the lake and in the trestle last referred to), we removed the ties and stringers as soon as possible after the filling was completed, as the filling at that time had a tendency, (which could be depended upon to occur in general practice), to crowd the bridge out of line, and the settling affected the surface and we considered it easier to keep the track in a good condition on the dump than it would be with the stringers in there.

The above is in reply to questions 1 and 2. In reference to question No. 3 he has never found it necessary to reinforce the bridge before commencing to fill as this work had been started before the bridge became weak enough to call for anything of this kind. I would remove stringers, ties, and guard rail, and in carrying up the filling keep it as nearly uniform in height as possible. If stringers in filled-in bridges are not removed until near the approach of winter, as a rule I would leave them in until next season. Our reason for doing so is that the filling would not have a chance to settle and after the ground was frozen it would be difficult to keep the track in good surface and line if the stringers had been removed. In general the material used makes a difference in filling bridges. Heavy clay, which forms into lumps, does not settle and pack as closely as gravel, slag, or sandy material."

Mr. Lemond of this committee finds on the Southern Railway that it is necessary to prepare broad, substantial foundations for bents before commencing to fill, and if more than 15 feet in height they put in additional longitudinal struts about half the distance from ground to top of bent and allow it to remain until it has to be removed to make room for workmen to pass. If trestle is over 20 feet high they place these struts at intervals of 10 feet apart. This contemplates filling from below with teams where practicable. They begin in the lowest place and fill in so as to keep the filling at uniform height at all times, except where trestle is located on a hillside,

when they use extreme caution to keep the filling on lower side at all times a little higher than on the upper side. It is important that base of fill be started at proper width and kept approximately at the same height, except that they find it an advantage to keep outer edges a little higher, the object being to keep the weight of the filling inclining towards the center, and retention of the moisture would also assist in the settling of the filling matter, assuming it to be earth. Timbers are removed there after the spring rains, and all bents put in good repair to last at least for two years before filling. This they calculate gives time for fills to settle before removing timbers, and they find it necessary to add to the original filling frequently before timbers are removed.

On the Bessemer & Lake Erie Railroad Mr. Cleveland of this committee advises that trestles have been filled until this practice is necessarily near its finish. This filling has been done usually with a centre plow and both sides brought up uniformly, keeping the dirt at about the same height on both sides, and no trouble has been occasioned by pressure in any direction. He has not found it necessary to reinforce trestles unless they should be practically unsafe before commencing to fill, and that condition is not allowed to obtain. Timber *above* the caps is all that is removed. It is considered unsafe to remove stringers from filled-in bridges in the fall ordinarily unless there is ample time for the filling to become solid before winter sets in. He finds that the time required for a fill to settle depends very largely upon the nature of the material used. They recently filled a 3,000-foot trestle with slag where the settlement was scarcely perceptible, but where clay was used they find it takes longer to settle. But in all cases their experience has been that there is less trouble in maintenance where fills have had ample time to settle before trains are run over them.

The following contribution is from Robert French, Roadmaster N. P. Railroad, where there has been much of this class of work done in recent years: "When filling a trestle of more than one deck material collects on caps and other horizontal timbers and causes them to break under this pressure, and often the filling material falls upon these timbers breaking them, the vertical pressure bends and breaks these timbers on account of material settling away from and under them. Lateral pressure seldom occurs against horizontal timbers that would cause damage or displacement. Lateral pressure is caused by slipping and sliding of the material rolling down the slopes, and its force is directed mainly against the plumb and batter posts. All posts are affected by the material slipping longitudinally or in the direction of the track where the slopes usually incline from 25 to 65 degrees. If a pile trestle, single deck, with piling reasonably sound, no precautions are needed unless piling are 35 feet and over, or with steep slopes. Extra

longitudinal, and perhaps lateral, bracing is required. Usual practice is to brace, strengthen, and replace inferior timber before starting to fill; also watch carefully during the work and rectify weak places as they show up and make such changes as may be necessary to carry work along safely. In cases of trestles of more than single deck it is a good plan to fill out to foot of slope by scraping with teams, and on the balance to use steam shovel and dump cars. If double deck bridge is all filled from on top, it will be necessary to strengthen the middle caps and braces, using care to overcome any injury due to slipping. Make fill loose, as much as possible filling the lowest places first; would not work from one end. Caps and all bent timbers remain in fill. If fill is made with good gravel or furnace slag the stringers may be taken out with perfect safety when weather is favorable and on approach of winter, provided there is gravel on hand to surface and raise track and better allow settlement of material before removing timbers."

On the O. S. L. and U. P. railways we have a great deal of this line of work to do, especially in the mountain districts, but as a rule the openings have been neither high nor long, and yardage was therefore small and the character of the earth generally dry and firm and chances for accidents correspondingly reduced, so that during the time of my connection with the B. and B. Department of the U. P. on the Wyoming division we had over 200 bridge openings filled over pipe culverts, concrete, stone, or other form of permanent water way; and during this period, extending over a term of about twenty years, and subsequently over four years with the O. S. L. Co. (which are under one management), no accident, however slight, has ever marked the progress of this work with us. The class of work which has proved most difficult in the line of trestle maintenance, during filling, is that which is built for the purpose of grade construction; however, in this case only small dump cars and engines, in use by contractors, are engaged on the work, and this feature of it is generally cared for by the grading contractor, and filling in is done as a rule from one end, and fresh filling, constantly shifting, makes it most difficult to retain bents in serviceable condition; but the purpose of this inquiry is not to deal with this branch of work, and we will not proceed with it further.

From the data here received your committee draw the following conclusions:

1st. That in high fills of timber trestles, breakages of horizontal timbers are unavoidable, as they are not supported except at bearings, and points where posts are *not* in direct contact with sills and caps are also subject to the same conditions, and will also give way under added tons of filling material, so that under a heavy fill it is safe to assume that the posts and portions of longitudinal timbers, with the actual bearings of

caps and sills in this vertical line of posts, are the only timbers not distorted and rendered worthless by the weight and settling of material in the fill, therefore it should be borne in mind that the vertical timbers and, more strictly speaking, the plumb posts, are the only supporting timbers unaffected by the pressure of the fills, as batter posts are affected in proportion to their inclination from a vertical line, and to insure stability in the structure during filling the best practice is to cut off all horizontal timbers when filling reaches a height so that they can be eliminated, as they would then be of no value in sustaining a vertical position of the bents, which (if filling is carried up evenly) would be insured by the filling matter all around the bent, and their use would only tend to throw the sill of next bent above from its natural bearing. These timbers need not be removed until dirt in the fill reaches them, when the necessity for their use no longer exists and their presence in their natural position would be a serious detriment to the structure, as it would be, in the fill.

2d. As we have considered in the foregoing the importance of keeping intact the natural position of vertical timbers, we find that the precaution of getting supporting posts in vertical line before filling is a necessary one, and more especially in the heavier fills, as the fills of trestles (say 20 feet in height or less, single deck) is much simpler and the trestle sufficiently rigid for practical purpose of carrying trains, is all right for resisting any pressure that could be exerted against it in filling, and a pile bent has the advantage of having no surface exposed to vertical pressure, which would be the reverse where frame bents are used supported by blocking, which bearing surface would be increased where ground is yielding and tendency to settle would be increased accordingly.

3d. It is generally recommended, and your committee concurs in the opinion, that the best results are obtained by carrying up the filling level, and in this way preventing the slipping of the filling, which would result in a lateral pressure and consequent displacing of bents or breaking of vertical timbers, and should such manner of filling for any reason not be practical or expedient, the trestle would be kept in better position by taking off sway-braces which would tend to obstruct the natural settlement of the filling, and the least resistance presented by the structure to the natural movement of the filling material will give best results in maintaining same during the filling period.

The foregoing is our opinion concerning question No. 4. In regard to question raised in No. 5, we find the *general* practice is to remove bridge ties, stringers, and guard rail, leaving in the caps to rot out in the fill. Since learning that this is the *usual* practice the chairman of this committee has not had the

opportunity of advising with other members as to whether it should be recommended as the *best* practice. The stand might be taken that it is immaterial whether the caps are released or not; that it takes time to remove them when time is an object to make the change between trains, etc. His individual method has always been to remove the caps; they are worth saving in this country and easily removed, and his opinion is that a firmer and better job results from the removal of the caps while it is torn up and ground is loose, and it is then permanently finished up. And unless a protest is entered by his associates on this committee, it will stand as the report that it is preferable to remove the caps along with the other timbers.

Relative to question No. 6, as to the best time for removal of these timbers, it is apparent that change must be made when frost is out of the ground, and change should be made also when dirt is dry and not in a rainy season. This of course is plain to any one having had charge of track maintenance, and if a general, absolute rule is to be laid down, the best time is during summer months and not so close to the freezing-up season as to have any great amount of settlement occur. After that time, however, in low fills where the settling is slight, we believe there are points of advantage in getting timbers out, as they can catch fire and cause possible trouble. If they break, there is no chance to detect it until it could be observed in surface of track, and it is our experience that such a filled-in bridge is not as easy to hold in surface and line as when track is on the dump. We have many calls for old timber, and a little old timber, we find, is an important factor in securing authority for needed structures along the line. A careful section foreman would not allow a trifling settlement where the bridge was to go unsurfaced if he had some cinders or gravel handy to lift it up with.

In regard to questions 7 and 8, it is found that where practicable it is an economical plan to grade in as much by team and scraper from below as can be conveniently reached, and such filling is pretty well packed as it is made, and this appears to be the usual practice, but in high fills it is of course necessary to fill in the greater bulk of it from the top. We have received no drawings illustrating methods for handling this class of work, and infer that they are not usually provided, and we believe if they were they could hardly prove of practical value.

This subject on some of the older railways of the country has ceased to be a subject of serious concern, as the general trend is, and has been for some time, towards the elimination of the timber trestle in *main* line bridges particularly, and the wisdom of such action is apparent to all who make the study of up-to-date railroading their business. Your committee is of the

opinion that the ideal condition will be attained when the timber trestle will be eliminated entirely.

A. H. KING, *Chairman.*
J. B. SHELDON.
H. D. CLEVELAND.
A. J. HART.
F. INGALLS.
J. S. LEMOND.

DISCUSSION.

Mr. King.—It is a question that has been disposed of on the Union Pacific and I found in corresponding with the members that some of them had but little to say, as if it did not interest them very much. I will, however, to start the discussion, make it a general proposition that filling should be carried up level and that as much should be graded in from below with teams and scrapers as is possible, and, when filling from the top, care should be taken to prevent any avoidable slipping. Of course the different classes of filling make a great difference in the results obtained. There is but little difficulty in filling low structures if solid material is used on a solid bed, and I believe that the only difficulty experienced would be on side hills where filling was heavy, and you must then take the precaution to carry the filling up level.

President.—I would like to ask Mr. King if he has investigated conditions where bridges are filled that are located on sink holes. It seems to me that is something pretty serious and should be handled very carefully.

Mr. King.—If it is a pile trestle to be filled, there is no chance for lateral compression, and I think in a case of that kind, if the filling is brought up to a uniform height, there is no chance for any displacement, and I think the only difficulty would be where piling may have been driven for foundations and trestles framed on them. Then I can see why under pressure these sills would be thrown out of position. If longitudinal timbers are used, cut them off so that no pressure could be exerted on them. It

is my opinion, however, that if a bridge is properly supported before filling and if there are no longitudinal timbers, there should be no difficulty.

Mr. R. H. Reid.—The question of filling in trestles over sink holes is one that we have met on the Lake Shore at various times. We have several large sink holes that have been filled in and all of them are now satisfactory. On one of them I suppose they were a year before they got it filled in and got the track in good shape. It kept on settling more or less, so that we had to keep on filling. We have no trouble with it now, however, and have not had for nearly 20 years. In another case we had a sink hole that went down so that we had to build a track around it for several hundred feet on private ground. We have that filled in now and have no trouble there. I think the place had been filled in for some time, as the road had been in operation for 25 years or more. This was 20 or 25 years ago. We do not know what started it, but the bottom dropped out and we had to start in filling. Probably they did not go down far enough at first to get a firm foundation. We have no trouble there now. Another fill made under my direction was on the "Old Road." We had a bridge across a marsh there and decided to fill it up as it was not needed and was causing more or less trouble. We filled and filled with the usual results. The trestle got out of shape so we had to put the filling up level with the top and put the stringers on top of that to maintain track. That was about 11 years ago and for the last 10 years we have had no trouble. We had another case about seven years ago, where we had a trestle about 375 feet long and about 25 feet high across a little channel between two small lakes. We decided to put in a wooden box drain there temporarily and later on put in an iron pipe inside of it. We made a fill there and framed the trestle on pile bents. The bridge was built by contract long before we acquired the road, so that we have only hearsay records, but the piles were supposed to be driven about 50

feet into the bottom, with frame bents on them. We put in the box and then started to fill in and, as we filled, it settled and kept on settling, and then commenced to go sideways and we had more trouble. It got to a point after a while where part of the trestle settled as much as 10 feet in one day and it kept us pretty busy keeping it up so that trains could run over it at all. We finally got to a point where we had it all filled up except 75 feet and this kept going down and the ground on either side kept heaving up. We put 3,500 carloads of filling in a hole 75 feet long, but finally got it so that it was all right.

Mr. J. F. Parker.—I believe the subject now under discussion is: The best way to take care of trestles while being filled. This would depend largely on conditions and whether filled by teams or train. On my division we have filled quite a number of bridges in the last few years and the most of them were filled by the team and scraper process. One of these bridges was 103 feet high and one on a 10-degree curve about 70 feet high. While the filling was being done, men were employed to tramp and pack the filling solidly around the bents, the balance being packed by the tramping of the teams. We only had about 18 inches of settlement and as soon as the filling was completed the stringers were removed and the track turned over to the section men; we have never had any trouble with our new fills.

Mr. Hart.—We have had considerable experience. My idea is to fill through first and then fill from both sides, packing the dirt around the posts and outside of the trestle, cutting out all the longitudinal bracing. In this way we have never had any trouble at all in filling trestles. We have filled them as high as 100 feet with good results and never stopped a train or endangered traffic in any way.

Speaking about filling in sink holes: Each one of them would be a proposition by itself; there are no two alike. We have one at the present time where we have

put on 14 sets of caps and it is still going down. The piling in the first place was 72 feet long. At another place there is 200 feet where we have put in 32,000 cubic yards. Our neighbor has put in 40,000 cubic yards. Following the way that I have outlined in taking care of trestles we have never had any trouble.

Mr. Steffens.—The sink holes spoken of remind me of conditions we have to meet in contending with the Hudson River mud, which is a very light material and displaces very readily. In filling it is necessary sometimes to sink old canal boats, if we can get them and if conditions will permit. In one case on the Hudson River Division it was found impossible to fill a trestle and the expedient was adopted of making a platform of logs, several layers thick, and placing the fill on that. That fill is standing today. It settles slightly in several years, enough so that the track has to be surfaced up occasionally. This subject is a very large one and has been taken up in the field to a large extent on the New York Central. Our division engineer has had great experience in the last three years and I hope to submit next year a paper covering all the points of interest.

Mr. Alexander.—This matter of filling trestles is one that is pretty well understood by all the members, but I might say that we follow the same procedure as is recommended, taking off the horizontal timbers when they can be spared, and we also remove every other tie, so that the filling may go down, and we put in blocks between the ties so that a wheel would not drop between. The bridge floor is comparatively safe for running trains and yet the filling may go through between the ties. We usually have our trestles filled by contract. Otherwise we have nothing to contend with. I might speak of sink holes. We had one particular case of this, a little place perhaps 300 feet long. When nearly filled, it settled quite badly. We widened the fill to keep dirt outside of the tie from rising up, and soon stopped it.

President.—The Southern Pacific, I believe, had a good deal of trouble in filling their bridge across Salt Lake.

Mr. King.—That piece of work is handled by the engineering department and I have not had a chance to see how it was done. They have had a good deal of trouble, however, in trying to accomplish this work. They drove temporary piling, as I understand it, and they were not driven to the depth that they would have put down permanent piles, and they have had a good deal of trouble extending over six months of the year. They have driven piles in there 90 feet long. After the time came when they were ready to fill, they commenced to fill with rock. It is simply a matter of having more material now, and there is no remedy except to keep on putting in rock and reinforce it by driving piling. Now they have it so that it keeps up in pretty good shape. This question, of course, relates to the maintenance of trestles while being filled. The body of this fill kept spreading and coming up on the sides.

Mr. Steffens.—Isn't there a Union Pacific man here who could give details of that? I also had in mind that Salt Lake affair just mentioned and have heard it said that the bottom was of crystalline salt and that the piles punched through the stratum into softer material.

Mr. King.—I understand that was the theory advanced in the first place.

Mr. Penwell.—My observation has been that the worst trouble in taking care of bridges while being filled is the fact that we run a train over it and unload the dirt and let it fall down any way it may. I think that while the dirt is being unloaded, or immediately after each train is unloaded, if you would have men go in there and tramp it down around the posts and then take off the longitudinal braces as you go along, you would do away with a good deal of trouble, and it is my experience that this is the most practical thing to do. We have not many sink holes, but have one place that we are investigating for filling. It is an opening about 800 feet long and 70 feet deep. A

20-foot arch will carry all the water and in addition to that we want a 20-foot arch for the roadway. We have been discussing the practicability of filling this place, and I have concluded that it can be done successfully if, while we are unloading this dirt, we put teams in there and begin the foundation full width and thoroughly tramp it down. The only question would be the length of time we could carry that steel structure in the ground. I think that if proper care is taken that we should have no trouble in filling up bridges.

Mr. Henson.—I have had some experience filling bridges. I had the care of a pile trestle while being filled that was over an opening 52 feet deep. We put in from 100 to 150 carloads of material a day. We used two plows, side plow and plow, to plow off both sides. We would plow the material off at any point we wanted it, some times anchoring the plow and pulling cars under it, unloading some 20 cars in one place. I took out all line girts and every other tie. Some few piles pulled down from the cap, although it was comparatively a new bridge. Four men took care of this bridge while being filled.

Mr. Hart.—Answering Mr. Penwell in regard to the length of time the structure could be carried in the ground after being filled. All the settlement you would have after a year would be hardly noticeable in carrying the track. Once in every couple of months you could bring up the track in shape. The first year, though, you can always figure on a ten per cent. shrinkage. I would always take out the ties and caps, leaving in all the balance. As I said before, I kept a man leveling the dirt around the posts and keeping it solid. I think if this is done, there will be no trouble whatever.

Mr. Perry.—We have filled up between three and four miles of trestle in the last few years by dumping the material through the top of the trestle between the ties down to the bottom of the trestle. We kept it leveled off as it was filled and we never had any serious trouble in filling our

trestles in this way. Last summer we filled up about three quarters of a mile in the same way.

As far as sink holes are concerned, we have had but few on the road. We had two in the last eight years and those we filled in with stone and slag. They were soft clay holes and, since being filled, we have not had any trouble with them.

Mr. Clark.—While I was with the P. & W. road, we filled a great many with molten slag and refuse from the iron works. By chemical action it cements almost into a solid rock. We have probably filled a couple of miles of it in the last 14 years.

Mr. Carpenter.—I have had some little experience in filling trestles, and in looking over the advance copy of this report I might speak of a few points which would be of interest to some of us. It is a common thing on our road to fill trestles, but we have filled only a few large structures. We filled one recently 25 feet high, where we had good soil, and had no trouble. We have had no difficulty whatever with vertical pressure on the horizontal timbers and very little with the lateral pressure. We have had a few piles pushed out of place but not so far but that we could carry the track on the same caps. I have been in the habit of reinforcing trestles somewhat, if they were advanced in age, by putting in new sills and renewing the sub-sills. We are now about to fill a trestle 24 feet high with dirt from an embankment on a new line which is about 20 feet track centers away. To overcome the side thrust we have put in braces against the batter post, as the greater pressure will come that way, although the intention is to fill this trestle with teams and scrapers. On this same ground we have not what you would exactly call sink holes, but there are one or two spots under the trestle, which were very soft, where we have had a good deal of trouble in keeping it in surface and line, it being on a four-degree curve. I made an attempt to overcome this by digging trenches running through between the bents and verging

into a general ditch leading longitudinally along the side of the trestle and into the creek. After that we had no trouble in keeping this trestle in line and surface, and with this process of draining the ground I anticipate very little trouble in keeping it in line. I shall be glad to say something on the result of this experiment at our next session, by which time we shall have had this trestle filled. We usually fill in our trestles and bridges by filling all over and not beginning at one end. Most of it has been with small dump cars. We fill the lowest place first and bring it up to a level; then form a trench along the center from end to end of the fill so that the rains will wet it down and solidify the fill. After we get it up to grade we remove every other tie and fill it right up to the surface. Then we put in a few ties and the section forces maintain the track, unless we have some soft material. In the case of higher trestles, we have one that has been filled about a year, all but about 60 feet in the center, where we contemplate putting in an arch. We will fill it this fall and take the stringers out. We do not remove anything below the stringers, and have in several cases left the stringers in over the winter. It is my experience that it is best to fill trestles from the top, as the drop of the dirt solidifies it.

Mr. Alexander.—Some three years ago we filled some trestles that were quite important—one on a six-degree curve, 20 feet high, and quite a long fill. We put up a small gasoline pump, laid piping and carried a hose up there and kept wetting it down. The result was that when we had it filled we took the stringers out and put ties on the dirt and never had any trouble. We have also done this with other bridges, and at one place where it was deeper than this. We decided that the filling should be settled. As this was connected with a steel bridge at both ends and we did not wish to have it out of surface, we filled it and wet it down and took the stringers out. I

consider this a good plan and would recommend that the filling be wet when convenient to do so.*

Mr. R. H. Reid.—We are filling now at Ashtabula a trestle between 75 and 80 feet high, which was built there for temporary use and of sound timber. We braced it horizontally and put on about all that we could see any reason for, and afterwards put on some more bracing and had it about as solid as possible. We commenced putting in about 150 cars a day and had a force of men below leveling and spreading it out to avoid horizontal crowding. Notwithstanding all the pains we took with that trestle, many of the braces crowded out. The last time I was down there I saw a long stretch of longitudinal bracing standing about eight or ten feet from the bents. At that time the trestle was buried so deeply in the dirt that it did not make any difference. Unless bracing is very heavy and put on firmly the filling will break it. In many cases this bracing has been crowded away or has been broken so as to be practically worthless.

Mr. Aldrich.—Speaking about your sink holes. Some years ago we had a sink hole on the New England road that we wanted filled. Our chief engineer thought it best to build a temporary trestle to run over while the old trestle was being filled. We did so. It was a trestle about 300 feet long, and we had driven piles in at one place about 80 feet long, driving the piles down flush with the mud. There was no bracing on the piles. We began to fill this trestle and got it filled about 13 feet in the deepest places, when these piles commenced to spread all over the bottom so far that it tipped right over on end. We put old flat cars for pontoons at the bottom, laid longitudinally, and laid our stringers on top of these pontoons. The mud kept rolling up until it got on a level with the original track and pushed our new trestle out of line. We then used telegraph poles and braced from tree to tree in the swamp so as to hold that

* The method mentioned is obviously of use only in cases where the filling material is of a light, dry variety, and would be of comparatively no value for clay or stone fills.—Ed.

temporary trestle. We finally held it and filled it, but today the mud is almost on a level with the track.

Speaking about filling trestles where there is a hard bottom. We had on the line a trestle, 105 feet deep at the deepest place, and they started to fill it with a plow, plowing the material off of flat cars by placing the cars on the trestle the entire length of the trestle and pulling the plow the whole length. They stopped them from continuing that way and had them place the cars over the deepest part and had it carried out on a level and in that way we filled it without any trouble.

I heard some of the members talk about taking off braces. I do not understand why they take off the braces. If a trestle is worn out so that they want to fill it I should think they would need the braces to hold it in place while it was being filled. Also in regard to tamping the dirt. It does not seem that they could do much with the material we have, which is mostly gravel. It does not seem to me that it needs much tamping.

President.—I think we have covered that subject pretty thoroughly and, if there is no further discussion, we will go to the next subject.

IV.—Best Forms of Construction for Engine Houses.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

In April, 1904, the following circular was mailed to all members of this Association and to others who might be interested in the subject:

The committee on the above subject desires your co-operation in the preparation of a report which will be of interest and value to all concerned.

The wording of the subject, "Best Forms of Construction," seems to indicate a somewhat general treatment of the matter, though any details of construction, such as heating, pits, roof, jacks, floors, etc., will no doubt be acceptable.

The committee earnestly requests information on the following lines:

1. Best form of engine house, whether round, rectangular, or other shape.
2. Arrangement of tracks, turntable, or transfer table.
3. Best materials for building, whether stone, brick, frame, frame and brick, or other type of construction.
4. Any information obtainable concerning heating, pits, roof, jacks, floors, etc.

Please send blue prints and information in detail wherever possible.

Any information or suggestions concerning new types of construction will be gladly received.

An early reply will be greatly appreciated, as we wish, if possible, to have the report completed before the beginning of the busy season.

Replies were received from twenty-five (25) members, many of whom sent complete blue prints of engine houses, with details of construction. These letters contain much useful information, and will be found in condensed form in the appendix to this report. The blue prints are here for the examination of any who are interested in general plan or details.

The round or partly circular engine house is, of course, by far the most common form of construction, and the best modern practice in the building of this type of engine house is shown by the blue prints which form a part of this report.

Different forms of rectangular engine houses have been used in England, Canada, and in this country. These may be generally divided into three classes: 1, Longitudinal tracks in rectangular building; 2, transverse tracks in rectangular building; 3, diagonal tracks in rectangular building.

The engine house of the Terminal Railway at St. Louis, Mo.,

plans of which are shown herewith, represents a partial combination of the first two classes. The engine house and machine shop of the Pere Marquette Railway Company is an instance of the second class. Your committee has been unable to secure any plans of the third type, although such a plan is mentioned in the following extract from an article on a "Comparison of Circular and Rectangular Engine Houses," in the editorial pages of the *Engineering News* of March 8, 1904:

"In our issue of October 19, 1889, appeared a paper on 'Railway Shops,' by Mr. J. Davis Barnett, assistant mechanical superintendent of the Grand Trunk Railway, in which reference was made to a common English type of rectangular engine house, with parallel longitudinal tracks and exits at each end. An example cited was an engine shed at Montreal, on the Grand Trunk Railway. This was 76x282 feet, with five tracks, accommodating 25 long engines with tenders. Another on the same road, at Lindsay, was 62x250 feet, with two through tracks (having continuous ash pits) for 10 running engines, and one through track for engines under repairs, being washed out or waiting under steam for trains. In our issue of May 9, 1891, in describing the shops and yards of the Union Pacific Railway at Cheyenne, Wyo., we presented a plan showing that a rectangular building with five parallel tracks 280 feet long would give the same capacity as the 30-stall roundhouse, but with a great economy in space covered. With exits at both ends, no more than two engines would have to be moved to get at any engine, but as a matter of fact, with a little systematic care in placing the engines, there need be little handling of the engines. The plan for rectangular houses suggested by Mr. Walter G. Berg, chief engineer of the Lehigh Valley Railway, provides for short transverse tracks through the building, thus avoiding the difficulty of handling engines on long tracks. In this connection we quote the following remarks from Mr. Berg's book on 'Buildings and Structures of American Railways':

"'Large square engine houses are sometimes preferable, owing to the shape of the ground space available for the house and track approaches, and also where an engine house is to be used for considerable repair work in addition to housing engines. Large square houses have marked advantages under certain conditions, and merit more attention in practice. An engine house for a limited number of engines consists usually of a rectangular building, with a length in excess of the largest engine used, and width dependent on the number of tracks. Sometimes it is made long enough to accommodate two or more engines on the same track; it is not good practice to place more than two engines in one stall, and even then there should be doors at the rear of the house, as otherwise it would be difficult to get out the rear engine if the one in front did not have steam up. The approach is usually by a ladder track. For very

large square engine houses, a transfer table is used with good results, especially where the transfer table is located some distance from the house, so as to give a space for engines to stand between the house and the table in case of fire. The advantages of a square house with special track approach are, that delays from breakdowns, blockades, or loss by fire are not so liable to occur; the house is cheaper and simpler to build, especially for a small house with only a few stalls; and the engine-house foreman will have a better oversight over the whole building than in a roundhouse, which is quite important where there is considerable work and repairs to be done around the engines. But the disadvantage of a track approach is that it takes up considerable ground space.'

"While roundhouses with the entire space roofed over, to form a circular rather than an annular building, are but little used, it will be of interest here to note some large roundhouses of this kind built by the Eastern Railway of France in 1892, at Noisy-le-Sec and at Troyes-Preize. At both of these places there are two roundhouses, with a repair shop between them. The roundhouses form complete circles, 230-foot radius, and are composed of steel arch ribs resting on pin bearings on low pedestals, and with their tops butting against a circular girder carrying the ventilator. The clear height is 84 feet 4 inches, or 108 feet 3 inches to the top of the ventilator. In the center is the turn-table, from which radiate 52 tracks. A diametrical track runs through both roundhouses and the shop between, and each house has also three of its radial tracks extended through the sides to connect with the yard tracks. A circular brick wall is built just outside the pedestals of the steel ribs, and light steel frames extend from this to the structural frame work to carry the lower part of the roof. The cost was $54,974 (or $1,696 per stall), as compared with $50,820 (or $1,588 per stall) for the older plan of an annular building. The extra cost was thought to be warranted by several advantages: 1, All handling of engines, cleaning, repairs, etc., is done under cover; 2, there is more space around the engines; 3, the lighting is better; and 4, the engines are far enough from the walls to permit of cleaning the tubes."

An article by Mr. George P. Nichols, in the same number of the *Engineering News* (March 3, 1904), shows a cross section of a proposed rectangular engine house, and comparative ground plans of circular and rectangular engine houses of about the same capacity. In connection with the use of an electric transfer table we quote the following from Mr. Nichols' article:

"Regarding the reliability of the electric transfer table as compared with the turn-table, after the experience of building a

large number of transfer tables used in all parts of the country and under every conceivable condition, I have found it to be equally as reliable as the turn-table. In fact, I have never known an electric transfer table, properly designed, to meet with any disabling mishap. As a matter of precaution, a hand attachment can be provided, which, however, I do not consider necessary. Should an extra precaution be deemed desirable, a second table can be provided to run in the same pit, which, of course, would increase the cost. The speed of a transfer table when loaded with a standard engine ready for the run, can be between 125 feet and 250 feet per minute, and with the high speed gear thrown in for moving the table when empty, the speed can be at least doubled. One of the largest tables built runs at a speed or 800 feet per minute when empty or with a light load."

As a slight basis of comparison between the circular form of house and the two most prominent rectangular types we present this brief table:

[Table No. 1.]

TABLE.	Circular or annular type.	One rectangular house, with transfer table in center.	Three rectangular or square houses with two transfer tables and ladder track.
	Per cent.	Per cent.	Per cent.
Ground area required for buildings..........	100	78	64
Floor area..........	100	87	66
Roof area..	100	123	66
Walls.................	100	62	64
Trackage in house, not including stalls......	100	50	....

The figures for circular or annular type were based on a house 429 feet in diameter with 75-foot turn-table, inside wall 92 feet from edge of table and stalls 85 feet deep; inside wall of house was taken at 24 feet high and outside wall at 20 feet. Capacity 54 engines.

The rectangular house was assumed to be 470 feet long and 242 feet wide, with 70-foot transfer table running lengthwise, leaving 85-foot stalls on either side. The end walls were taken at 20 feet high at outside and 32 feet high at center.

These are similar to the comparative plans of Mr. Geo. P. Nichols in the *Engineering News* of March 3, 1904.

For the three rectangular houses with two transfer tables the plan of the Terminal Railway Association of St. Louis, Mo., was taken, assuming height of 24 feet for ends of building at outside and 28 feet at center.

In the appendix will be found a letter from Mr. Nichols, giving comparative estimate of the cost of circular and rectangular engine houses of same capacity.

A turn-table or a "Y" track is, of course, necessary in connection with a rectangular house. A combination transfer table and turn-table has been suggested. This would require additional depth of transfer-table pit and extra weight to be handled in moving back and forth.

A general summary of the points favorable to rectangular and round engine houses, as they appear to your committee, follows.

Points to be considered favorable to rectangular engine houses:

1. Economy of ground used for building.

2. Uniform room at front and rear of engines while in house, making it easier to work on engines in the house.

3. Economy in construction of walls, floor, and possibly roof.

4. Economy in piping for heating, water, steam, and lighting.

5. Opportunities for pit drainage, which could be straight, open drain under transfer table.

6. Erecting shop, machine, and washout section can be in connection with engine house, and either can be utilized as circumstance may require, thus concentrating building, men, and tools.

7. Only one, or perhaps two, outside doors required, one incoming, one outgoing; less heating and repairs.

8. More open to inspection and more uniform light.

9. No bother with turn-table radial tracks in winter.

10. Less bother with snow and ice in turn-table pits and around engine-house doors.

Points to be considered favorable to circular engine houses:

1. Close proximity to turn-table, making the despatching of engines a matter of very little delay.

2. The handling of one engine between house and turn-table without any relation to any other part of the house.

3. Saving of expense of transfer table and cost of operating.

4. Economy of ground space when track approaches and outside turn-table for rectangular engine house are considered.

Plans of engine houses of the circular or segmental type have been received from Mr. Reid of the L. S. & M. S. Ry., Mr. Sheldon of the N. Y., N. H. & H. Ry., Mr. Carr of the Michigan Central Ry., Mr. Markley of the C. & E. I. Ry., Mr. Patton of the Grand Trunk Ry., Mr. Snow of the Boston & Maine R. R., Mr. F. P. Gutelius of the Canadian Pacific Ry., and Mr. L. D. Smith of the Gulf, Colorado & Sante Fé Ry. The C. & N. W. Ry. standards, Nos. 1, 2, and 3, are also submitted.

Most of these sets of drawings are very complete, and indicate the best and most modern practice in this type of engine house up to the present time. The blue prints and drawings are here for your examination. A few of the ground plans and elevations will be reproduced to accompany this report. It is impossible to make a choice from the many excellent features of these different plans, and a study of the blue prints will well repay any one interested in details of engine-house construction. In them you will find complete designs for cinder pits, drop pits, pipe conduits, location of heating and blow-off pipes, doors, etc., in addition to the building proper.

The following table gives some of the principal dimensions,—dimensions of different roundhouses:

[Table No. 2.]

Railway.	Length of turn-table.	Center of turn-table to edge of house.	Depth of house.	Walls.	Found.	Cost per stall.
C. P. Ry	71.0	95	80 (center).	Steel; Concrete.	Concrete.	
M. C. Ry	70.0	80	78 "	Brick.	Stone.	
B. & Maine Ry	61.0	95	75 "	Brick.	Stone.	
G. T. Ry	70.0	82.9	82 "	Brick.	Stone.	
C. & N. W. Ry., S. No. 1	70.0	87.0	84 "	Brick.	Stone.	$2,000, not inc. heating and drainage.
G. C. & S. F. Ry	60.0	121.5	85 "	Brick; Steel.	Stone.	$1,200, inc. water, steam, and air pipes, brick floor; not heating.
N. Y., N. H. & H. Ry	60.0	61.0	71 "	Brick; Shale.	Stone.	
C. & E. I. Ry	75.0	124.0	85 "	Brick.	Concrete.	$1,652.
L. S. & M. S. Ry	85.0	111.6	92 "	Brick.	Concrete.	

Among the blue prints sent to the committee is one from the Gulf, Colorado & Santa Fe Ry., showing complete plans for proposed Southern type engine house to be used in southern Texas. This Southern type is exceptionally high, being 18 feet at the side next to the turn-table, 31 feet on opposite side, and 38 feet at apex of roof. It is provided with a continuous louver placed at the apex of roof and extending clear around the house. This takes the place of smoke-jacks which are done away with entirely. The slope of the main roof is $\frac{3}{8}$ inch in 12 inches and the extra height is obtained by two vertical raises of about five feet each ; windows are provided at each of these points. The outside high wall is pierced with windows clear to the roof. This plan should result in exceptionally good light and ventilation.

The C. & N. W. Ry. plans show standard No. 1 engine house. This type of house has been built at South Omaha, Neb., with 12 stalls, and at Mason City, Iowa, with 15 stalls. These houses are giving good satisfaction. Briefly, the details are : Brick walls on stone foundation, stone cinder pits, roof of mill construction resting on wooden posts ; pitch of roof $\frac{3}{4}$ inch in one foot, roof covering tar and gravel. The pits drain into a 3-foot conduit which runs around the house just inside of the inside wall. (See illustration.)

The cost of a 12-stall engine house built on this plan in 1901 at South Omaha, Nebraska, was $26,825, including a 16x64 ft. heating addition. This covers the building, steel jacks, and painting. The B. F. Sturtevant hot air system of heating was installed at a cost of $3,000, including fan, engine, coils, and piping. An 80 H. P. boiler cost $1,250. The piping for water, exhaust steam, and wash out cost $70.

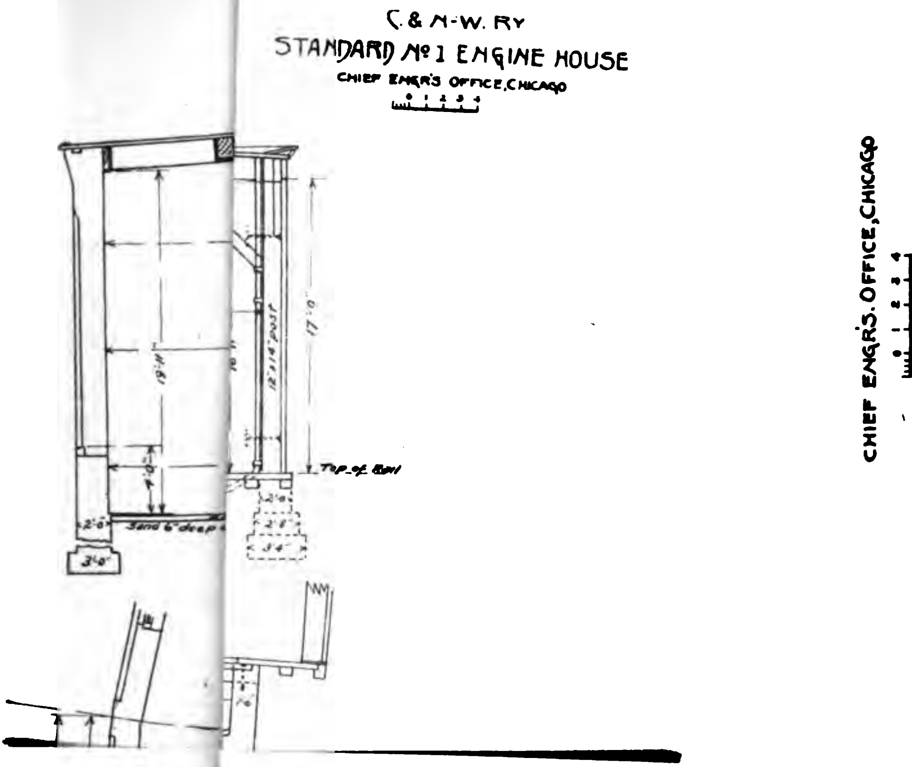


FIG. 17.—Standard No. 1 Engine House, C. & N. W. Ry.

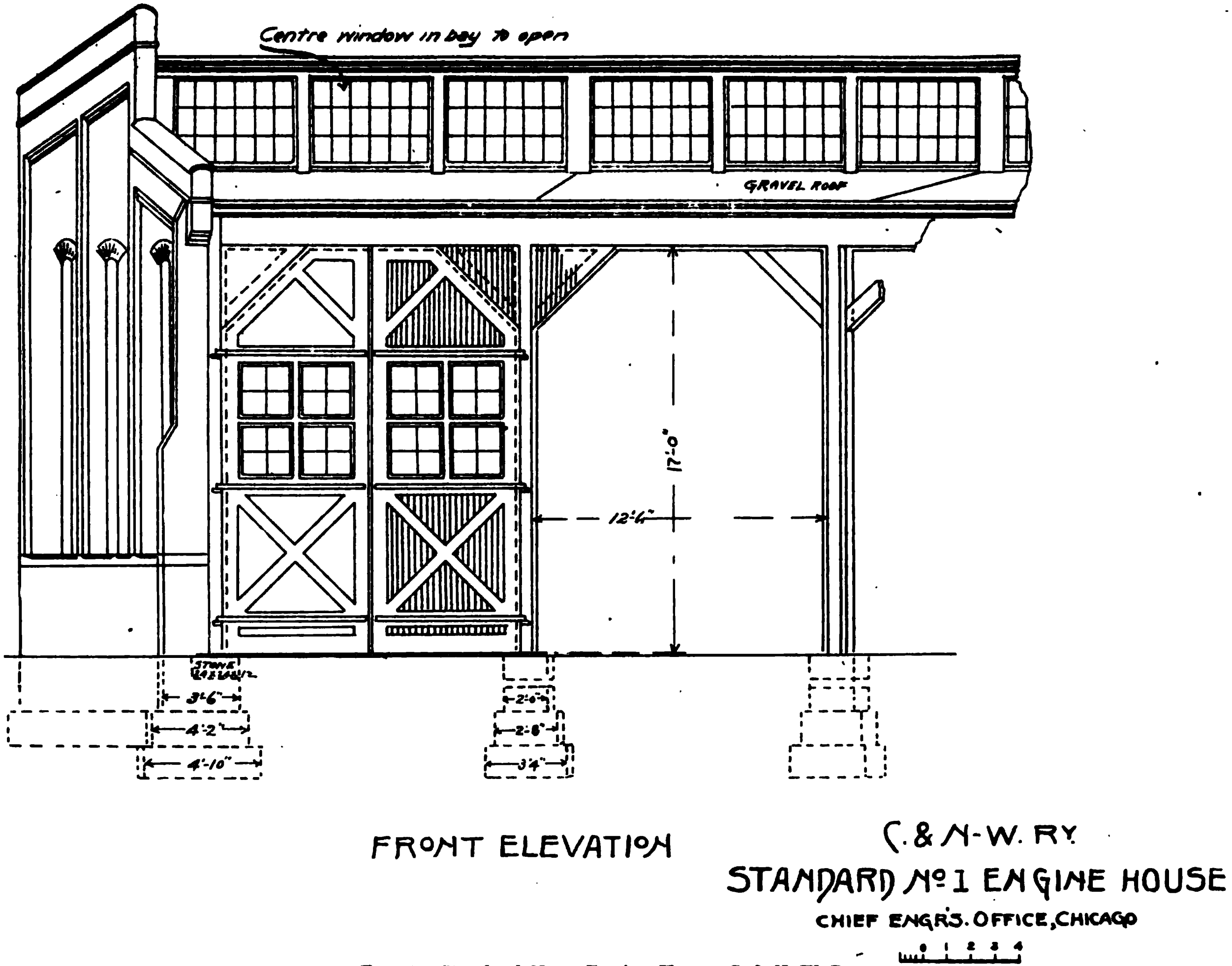


FIG. 17.—Standard No. 1 Engine House, C. & N. W. Ry.

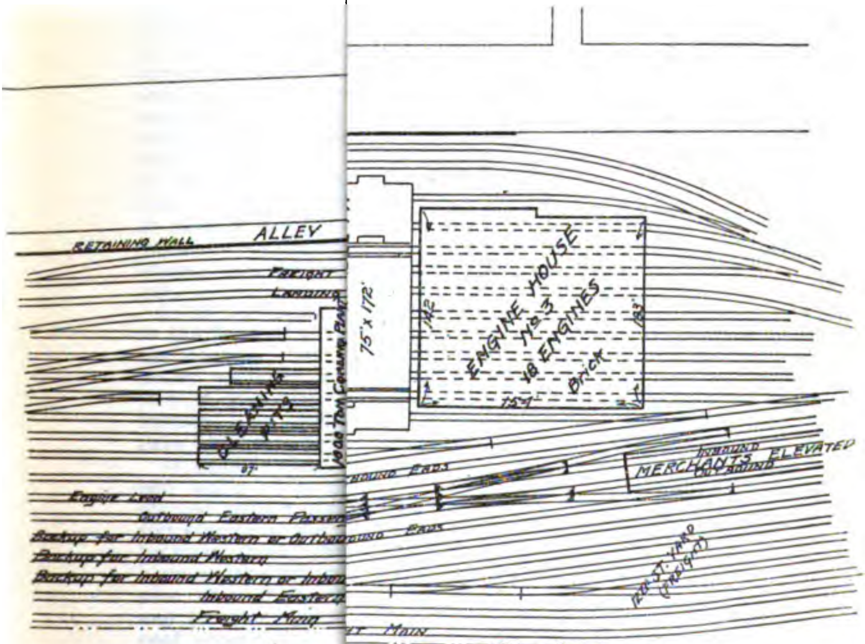
Through the kindness of Mr. W. M. Camp of the *Railway and Engineering Review* we are able to present the following description and cuts representing the new plant installed by the Terminal Railway of St. Louis for handling locomotives. This article first appeared in *Railway and Engineering Review* of October 15, 1904.

NEW SQUARE ENGINE HOUSES.

The idea of building engine houses at terminals in rectangular instead of circular form, as has been the custom in this country from the beginning, has attracted much interested attention from motive-power men, especially since it has become imperative at many places to enlarge the storage facilities for both the increased size and number of locomotives. The use of a circular building served by a turn-table in its center has so many advantages in the matter of convenience and compactness that most railroad companies are still clinging to it even when it is found that an entirely new building will be necessary in order to get storage room for but a few more locomotives. The rectangular form of engine house served by a transfer table, however, also has its advantages and in many cases they outrank the disadvantages to so great an extent that that form of construction is being installed.

In a paper presented before the Western Railway Club on February 16, 1904, Mr. George P. Nichols compares the two forms and points of the main advantages of the rectangular house, in that it occupies less space for the same capacity and can be easily and cheaply extended if necessary. The plan advocated in the paper places the transfer table under the same roof with the pits, thus doing away with trouble from snow and ice in the transfer pit in the winter as well as dispensing with large doors altogether. Other advantages in the matter of heating, lighting, use of cranes for repairs and open space around engine pits are also shown clearly in this paper. The chief and practically only disadvantage of this design is the necessity of providing means for turning the engines, which will have to be provided somewhere outside of the building, either in shape of a Y or turn-table on the lead to the house.

There are probably more trains handled at the Union Station, St. Louis, which is owned and operated by the Terminal Railroad Association of St. Louis, particularly during the rush caused by the World's Fair this year, than at any other one point in the country. This fact necessitates the use of terminal facilities for handling locomotives rapidly and without congestion. In preparing for the rush of the World's Fair season, terminal arrangements at the Union Station have been enlarged and improved, and in connection with this work new engine houses and coal-handling plant have been built near 14th street, at a point convenient to the Union Station. In our issue of April 30, we gave a complete description of the very large coal-handling plant erected in connection with the engine houses, and are now able to give details of construction of the houses themselves.



TERMINAL R. R. ASSN.
GENERAL PLAN
...ALING STATION AND ENGINE HOUSES
FOURTEENTH ST., ST. LOUIS
SCALE 0 — 50 FEB. 1904

Referring to Figure 18, the general relations of the building and tracks can be seen. There are three distinct engine houses being served by four tables, two in each pit between the houses. The first house nearest the coaling plant and the Union Station has a capacity of 19 engines, the center one of 24 engines, and the third one of 18 engines, giving a total capacity of 61 engines. Because of the mild winters in St. Louis, there is no necessity of covering the transfer-table pits by a roof as recommended by Mr. Nichols in his paper, and the houses are built to accommodate two engines on each track, space being left in the center for trucking. The houses are built close to the transfer-table pit, there being less than six feet between the edge of the pit and the doors, and in other ways space is economized as much as possible. The arrangement of tracks in connection with the houses can be seen to be particularly well adapted for this type of house, entrance being given to all pits at the two outside houses without the use of a transfer table. Arrangement is also made for getting an engine in or out from the center house and inside pits of the outer two houses without difficulty, by having extra leads come into the transfer-table pits at either end, which makes it practically impossible to block an engine, no matter where she may be placed, as long as the leads are kept clear. There is little or no repairing done at this point and, as most of the power is in passenger or switching service, working on a regular schedule, the engines can be so located at the houses that they will have easy exit when it is time to take them out.

It will be noted by Figure 18, there is no provision made either in the form of a Y or turn-table in the engine houses for turning the engines, but as the switch engines do not need turning under ordinary circumstances, and the arrangement of tracks is such that there are a number of Y's just outside of the Union Station (see *Railway and Engineering Review*, March 28, 1903, page 263) this point did not need attention.

In construction, the houses are very simple, consisting of two end walls of brick, being laid on a concrete foundation and pierced with a large number of windows. The side walls consist simply of the posts supporting the roof, and of rolling doors between them, there being but a narrow strip of brick work between the top of the doors and the roof. Figure 19 shows a plan view of the center house in which the arrangement of pits and location of posts and pilasters can be clearly seen. The roof construction is of wood throughout and consists of long wooden trusses extending parallel and between each set of pits and supported on three wooden posts, one in the center, and the one at either end forming part of the outer wall. The general construction of this truss is shown in Fig. 20. It is composed of two long 10 x 10-inch timbers with cross supports and tie rods forming a simple design of trussing for carrying the weight of the roof over the long span between supports. The main longitudinal members, on account of the extreme length, are made up of several pieces spliced together, the details of the splicing being given in Fig. 20. In the center of the house is a ventilator extending across the whole width. This is of simple wood construction, and the windows forming the two sides are arranged to swing in their center and can be operated from

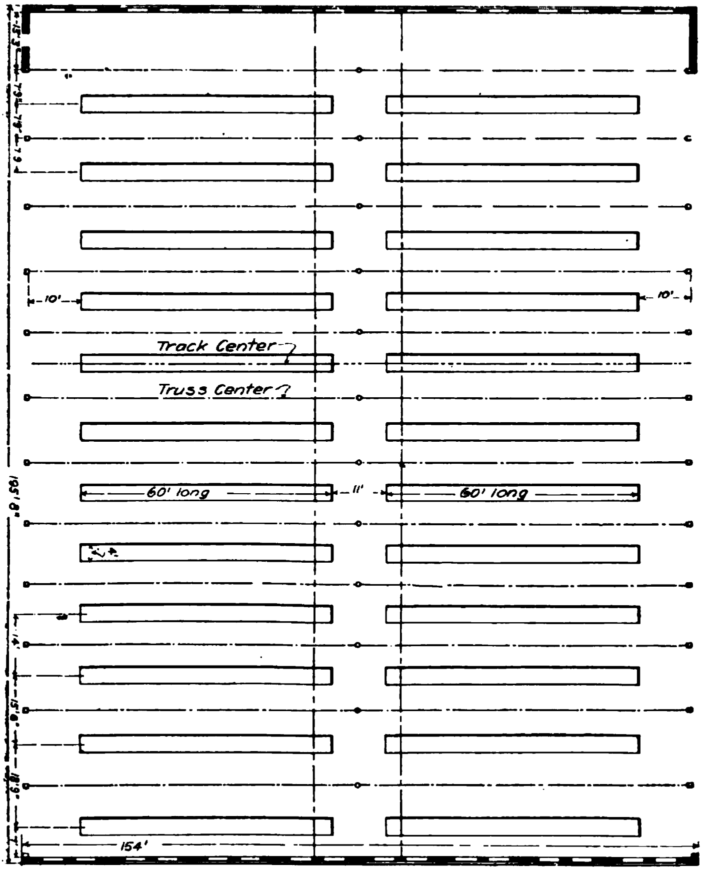


FIG. 19.—Plan of Square Engine House at St. Louis.

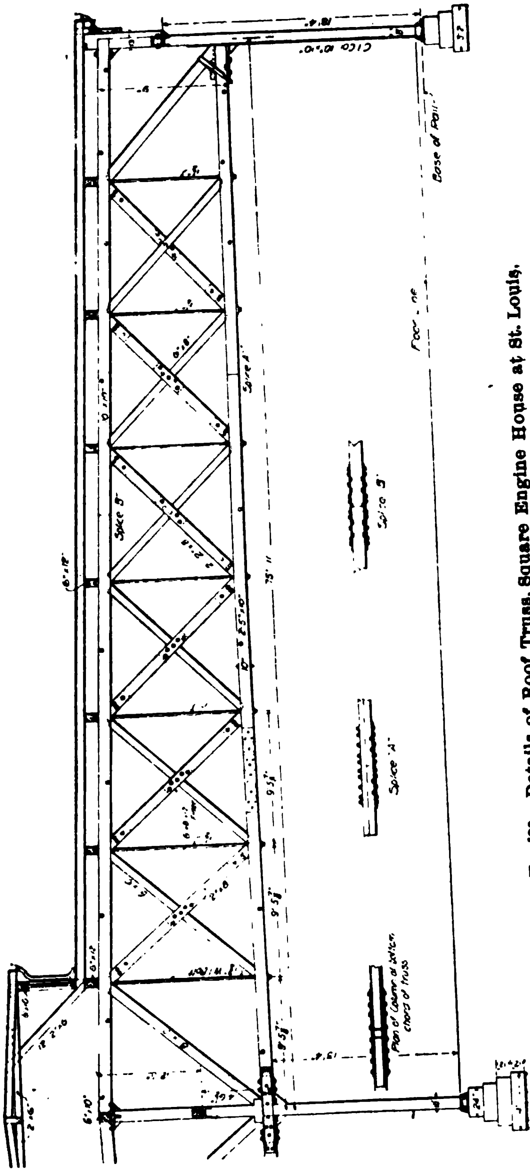


FIG. 120.—Details of Roof Truss, Square Engine House at St. Louis.

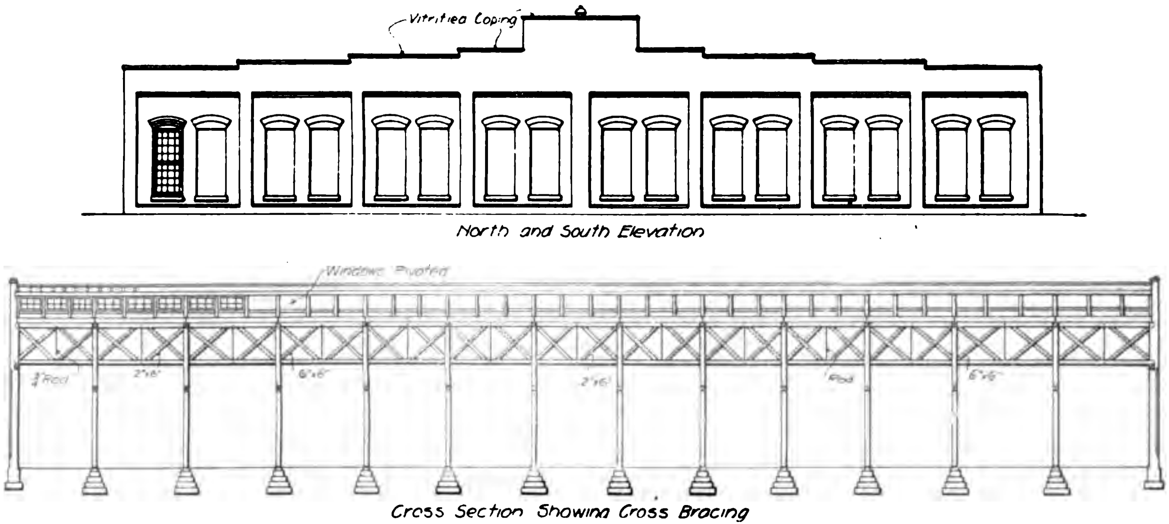


FIG. 21.—Elevation and Cross Section of Square Engine House at St. Louis.

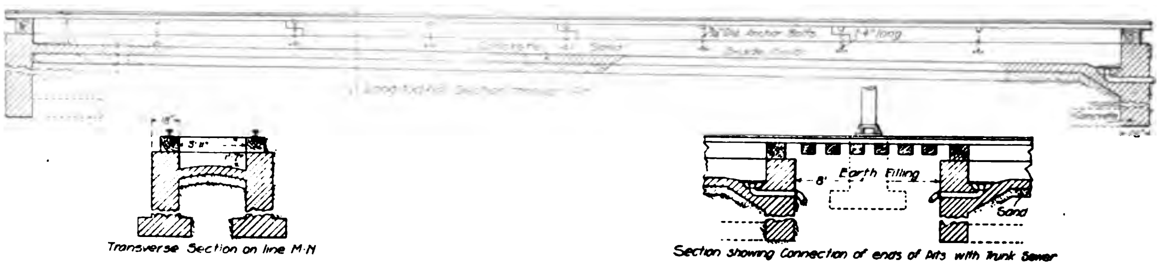


FIG. 22.—Construction of Pits, Square Engine House at St. Louis.

below. The general form of construction of this is also shown in Fig. 20. The long trusses are cross-braced by 6 x 12 stringers, located at each tie rod, which support the roof. The series of cross-bracing in the center, shown in Fig. 21, and the supports for the brick work at the ends, act as stiffeners and make a sufficiently strong and rigid structure. The roof is of five-ply composition laid on planks fastened to the 6 x 12-inch stringers. The posts supporting the trusses are set in cast-iron seats resting on a concrete foundation, which extends four feet below the surface, having a base four feet square, and rises in four steps to half that size. Details shown in Fig. 20.

The doors at the ends of the pits are rolling steel, manufactured by Kinnear Manufacturing Company, and are so counterbalanced that they can be easily raised and lowered by hand by means of a chain running over a chain wheel on the rollers. This type of construction takes up absolutely no valuable room and allows the transfer-table pit to be brought close to the side of the house, and also gives a maximum opening for entrance.

The smoke jacks, built by the Paul-Dickenson Company, have a wide flaring bottom which does not make it necessary to place the engine under the exact center of the jack in order to have it of value. There are two jacks for each pit, one located at either end, as is evidently necessary, inasmuch as the engines are not turned,

The pits, details of which show in Fig. 22, are built of heavy concrete sides extending down some distance with a broad base. A six-inch convex concrete bottom has a decided slope toward the center of the house, where the drains are located, all coming into a main sewer pipe in the center between the pits. The concrete sides are capped by 10 x 12 timbers held in place by a number of anchor bolts embedded in the concrete. The rails are spiked to the top of these timbers. The floor between the pits is of sand with a cinder top dressing. The heating is by hot air from the Buffalo Forge Company's fan and coils, steam being obtained from the power house near the Union Station. The air is conducted from the fan by two large heater pipes running at about the center of each side on the roof trusses and having outlets between each pair of pits. The lighting is by electricity and consists of a row of incandescent lights hung from the main roof trusses, the lights between each pit being brought to a separate switch. The current is furnished from the main power house. The water and compressed air connections come up from below at the base of the center post, there being one connection to each for every pit. One pit of the center house is given up to a small machine shop containing the few machines necessary for ordinary running repairs, which are dirven by an electric motor. There is also a forge and small hammer included. The foreman's office and bulletin boards are also located in this space.

The transfer-tables, of which there are two in each transfer pit, are shown in Figuge 23. These tables are driven by electricity, using an induction motor on a two-phase alternating circuit. Current is obtained through collectors from wires which are supported on insulators on either side of the wooden timbers supporting the intermediate rails. A sloping cover

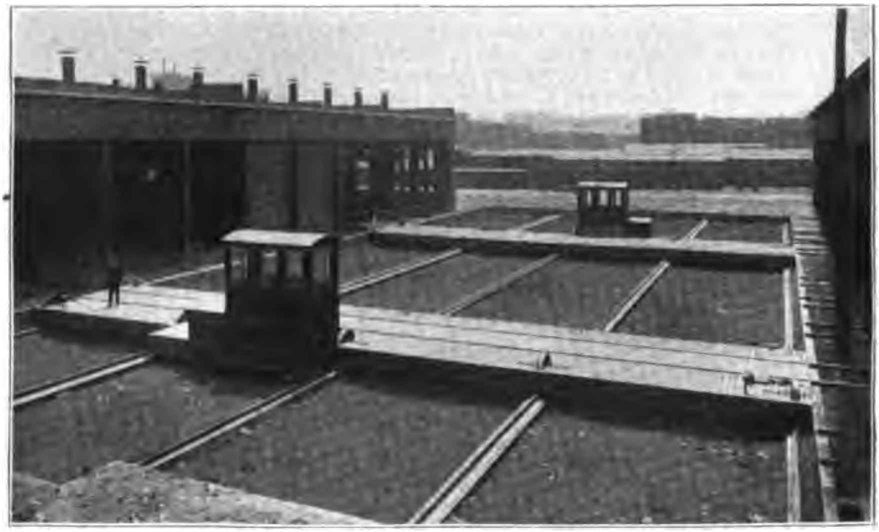


Fig. 23.—Transfer Tables between Square Engine Houses at St. Louis.

Fig. 24.—View of Rolling Steel Doors and Transfer Table Pit, Square Engine House at St. Louis.

Fig. 25.—View Showing Interior of Square Engine House at St. Louis.

protects the wires from rain or snow. This construction shows plainly in Figure 24. There is one reversing motor on each table which is connected to the winding drum or to the table drives through an interlocking set of gears, so arranged that but one set can be in operation at a time. There are two driving speeds, one of 125 feet per minute for a loaded table, and one of 300 feet per minute for running light. The two tables in the same pit are so built that they will accommodate adjacent tracks at the same time. A light with a reflector on each end of the tables shows the operator in the cab when the rails are lined up. The cab containing all the controlling apparatus is entirely enclosed and all parts of the machinery, which the weather would damage, are very carefully covered. A signal on top of the cab shows the hostler when it is safe to run on to the table.

In Fig. 6 (not shown) the coaling station shows in the distance on the extreme left and the general appearance and relation of the three engine houses can be clearly seen. Figure 25 shows the interior of one of the houses, giving a good idea of the arrangement of roof trusses and the construction of the pits. Figure 24 shows an exterior view. In this the appearance of the rolling steel doors, the shallowness of the transfer-table pit and the contact wires for the table can be seen.

These houses were designed by the engineering department of the Terminal Railroad Association of St. Louis, to whom we are indebted for blue prints and information.

G. A. Damon, Arnold Electric Power Station Co., Chicago, Ill., describes engine house and machine shop designed by his company for the Pere Marquette Ry. Co., as follows:

In reference to the operation of the house, the transfer table is designed with several special features, the end in view being absolute reliability and rapidity of service. The table is equipped with two motors with series parallel controllers, the same as in use upon modern street cars, and in addition to the motor equipment an auxiliary gasoline engine has been provided, complete with air starter, for use in case of accident to the power plant or at times when the power plant could be closed down to advantage. The transfer table has a capacity of 175 tons, and will operate upon a speed ranging from 200 to 800 feet per minute when run by the two 25 H. P. motors. When operated by the gasoline engine it operates at about one half normal speed. The table was furnished under our specifications by George P. Nichols & Bro. of Chicago. You will note that rolling wood shutters are used for all the track doors opening on the transfer table. (See illustration.)

The standard first-class engine house of the Canadian Pacific Railway is described as follows by Mr. F. P. Gutelius:

"The special feature in connection with these buildings is the reinforced concrete roof and the fact that all steel work in these buildings is protected by concrete from the effects of gases." (See appendix for full text of letter and illustrations. —Ed.)

R. H. Reid, L. S. & M. S. Ry., Cleveland, Ohio, describes engine house built by his company, as follows:

We are now building a new roundhouse, coaling plant, boiler house, etc., at Elkhart, Ind., and I enclose some of the plans which will show the main features of the construction and arrangement.

Generally speaking our people seem to prefer the roundhouse with a turn-table arrangement rather than the rectangular house with the transfer table and "Y" or turn-table at some other point, as of course the engines must be turned to get back and forth over the road, and there is not always room to build a "Y" for turning them, and if a turn-table must be used it would seem desirable to build it so that it will be concentric with the house, and not require another table to put engines into the different stalls. I think, also, that the turn-table is quicker to use than the transfer table, as it does not have to be moved so far to meet the different tracks of the house. I think the roof construction should have as little iron in it as possible. If trusses are used they should be timber, but in my judgment it is desirable to use wooden posts and beam construction so far as possible on account of corrosion and rusting due to smoke and steam, as our experience with iron trusses in roundhouses

Top of col.

has been very unsatisfactory. In several cases the iron rods and bars in trusses have rusted completely away. (See illustration.)

Mr. J. B. Sheldon, N. Y., N. H. & H. Ry. Co., Providence, R. I., describes engine house built by his company, as follows :

The house shown on sketch tracing was built in Blackstone, Mass., in 1891, and is of steel skeleton construction with walls of brick eight inches thick, the steel frame showing on both sides of the wall. The roof has wood rafters laid on steel trusses and is boarded with 2-inch tongue and grooved spruce, and is covered with four-ply felt paper mopped on top with roofing pitch and beach gravel spread evenly over the entire roof. The house is equipped with wood smoke-jacks and ventilators. The floor is of coal-tar concrete four inches thick. Pits have 16-inch side walls with 8-inch granite cap. Bottom of pits are paved with brick and grade is toward the front with a gutter across the front of all pits with an 8-inch tile connection between all pits. All gutters and openings are covered with iron gratings. Steam pipes lead along the sides of pits for heating and are all connected at the back end of pits to the main supply pipe. The entire front of house is taken up with doors and windows, no brick being used. This house has been in use since 1891. The steel frame has been painted twice since built and is in fair condition. The floors and the roof are in good order and nothing has been done to them since building was built. (See illustration.)

A. S. Markley, C. & E. I. Ry. Co., Danville, Ill. :

During the past year this company has constructed a thirty-six stall roundhouse, which, when the circle is completed, will contain fifty-six stalls, all of which has been constructed of shale brick with gravel roof and concrete foundation, together with concrete engine pits as well as other foundations in connection with it. You will notice there is an 8-inch timber on top of the engine pits, which we believed was necessary in order to prevent the rails from wearing into the concrete. All the floors in the roundhouse are brought up level with the top of rail laid with paving brick edgewise and grouted between the brick with cement grout to hold them in place. The building is heated throughout with the Sturtevant system of heating, with 25 H. P. No. 10 fan, the fan running 2,200 revolutions per minute. The air is conveyed from pit to pit through a concrete conduit, the outer foundation wall of the roundhouse forming a part of this conduit ; the bottom and sides being six and twelve inches thick respectively ; the cover being six inches thick in the centre reinforced with expanded metal, the surface of which is used for a walk and truckway in the roundhouse. The heated air is supplied to the house through "branches" to the various pits through vitrified sewer pipe thoroughly cemented as well as wall registers conveniently located in the walls. The building is lighted with electricity throughout.

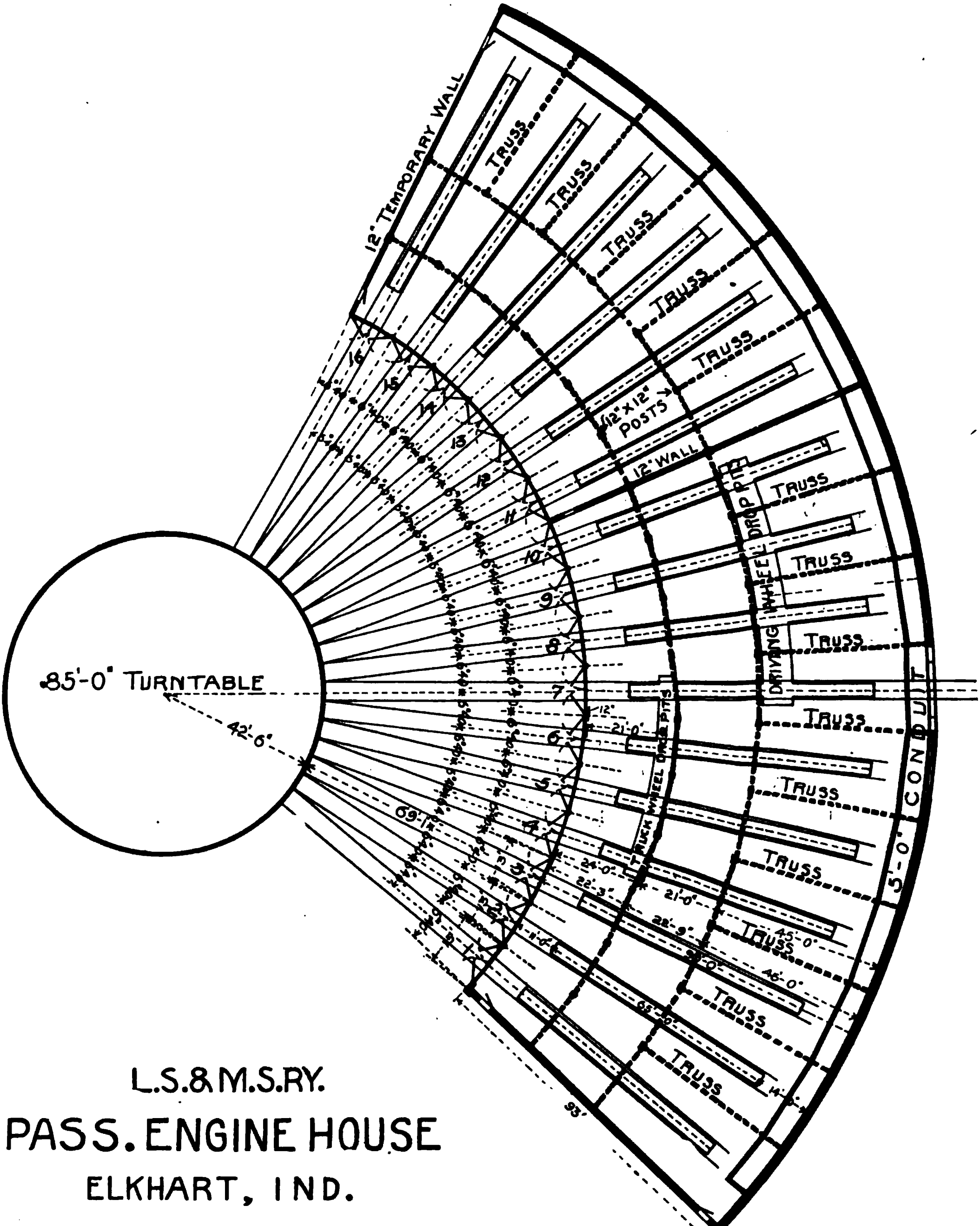


FIG. 28.—Passenger Engine House, Elkhart, Ind., L. S. & M. S. Ry.

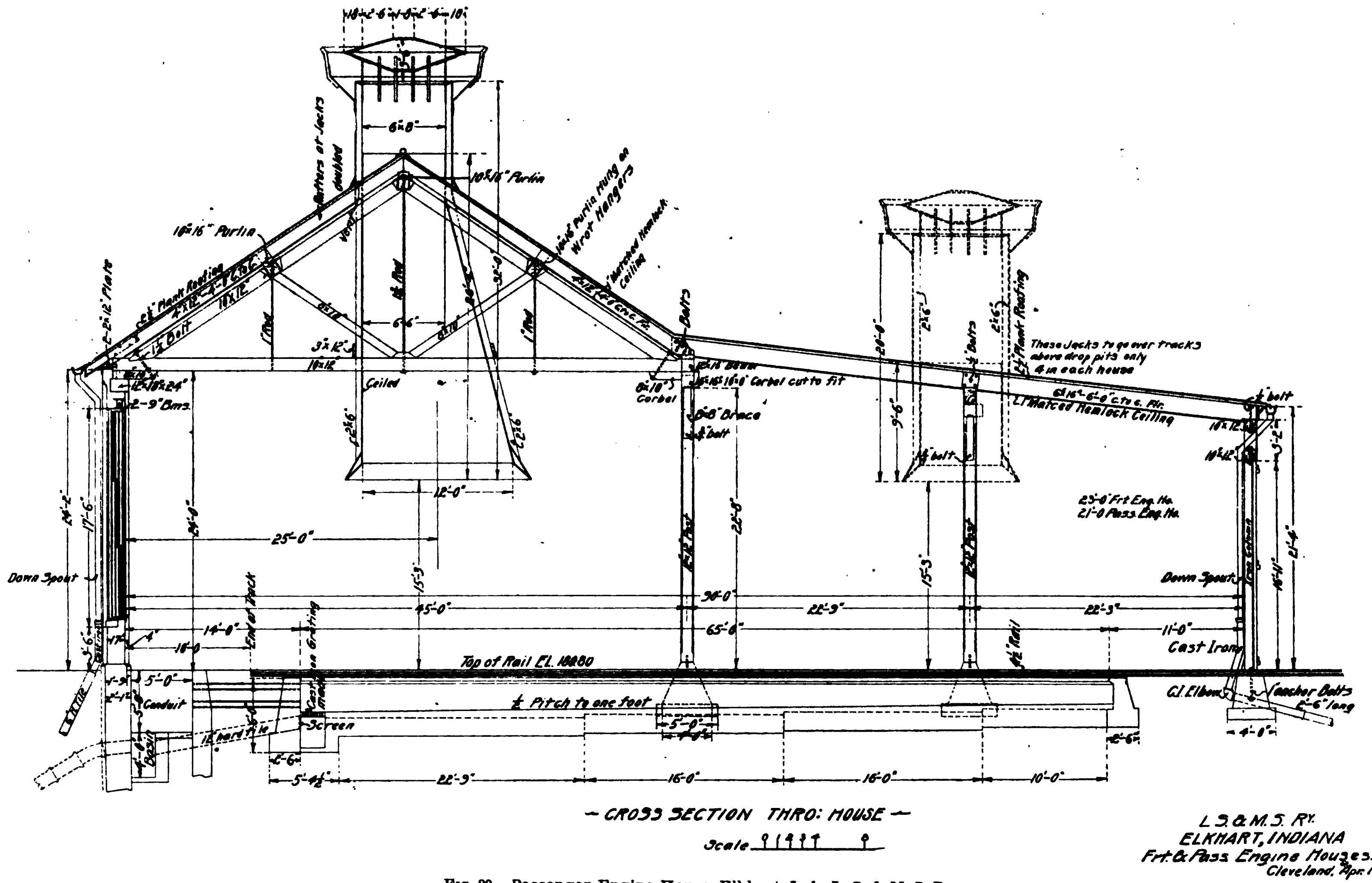


FIG. 29.—Passenger Engine House, Elkhart, Ind., L. S. & M. S. Ry.

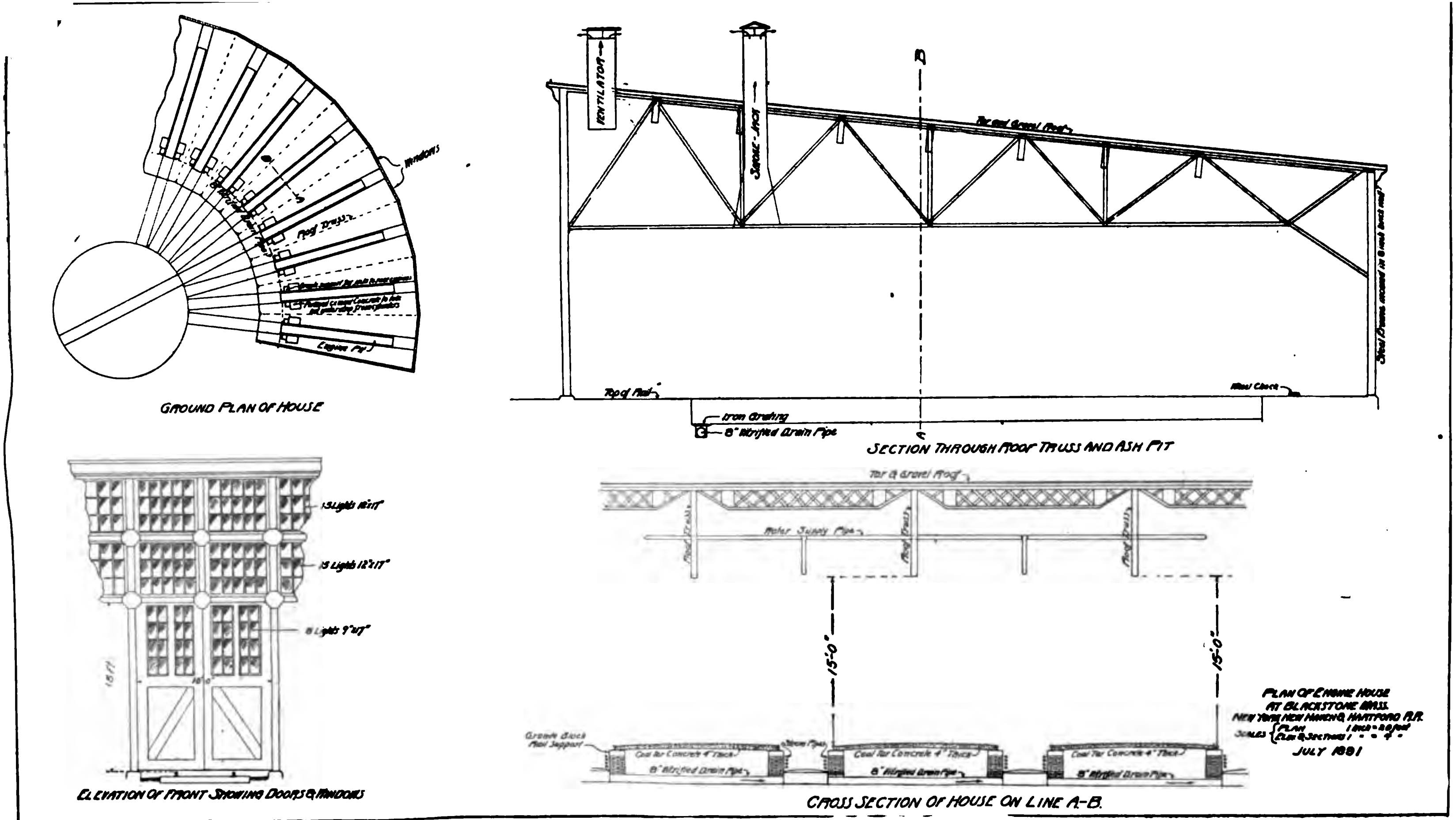


FIG. 90.—Engine House at Blackstone, Mass., N. Y., N. H. & H. R. R.

steam and water pipes are placed overhead where all can be repaired without disturbing any part of the building. Wooden smoke-jacks are used throughout the building, which are of our standard pattern. The turn-table is a 75-foot conical roller centre, driven with electric motor furnished by G. P. Nichols & Bros. The walls surrounding the turn-table as well as the floor, together with the centre after having driven fifteen piles to solid rock, are concrete. We feel as though we have a modern roundhouse; a great deal of care and pains were taken by our chief engineer to make thorough investigation of those built throughout the the country, and after doing so this plan was adopted. With six months' use there has been no reason to change our opinion in this direction or make any changes whatever should we ever have occasion to build a new house. The square houses for holding locomotives recently introduced, I believe will be more generally used in the future than the round ones on account of their economical construction and maintenance as well as additional light and considerable more space for engines with less area of ground. Transfer table, 75 feet long, installed by G. P. Nichols at Oak Lawn shops (see illustration), near Danville, Ill., has been in service for the past year. It is electrically driven, and has given the best satisfaction in every particular, not only in device for running the table but for the device for pulling dead engines on and off the table into the machine shop.

The following articles in technical magazines and in our own proceedings contain much information in regard to details of engine-house construction :

1. Roundhouse—I. C. Ry. of Canada, *Railway Review* of March 12, 1904.

2. U. P. Ry. Shops, *Engineering News*, May 9, 1891.

3. Comparison of Circular and Rectangular Engine Houses, *Engineering News*, March 3, 1904.

4. Brick Floors, Eighth Annual Convention B. & B. Association, page 102.

5. Smoke Jacks and Ventilators, Eighth Convention B. & B. Association, page 112.

6. Turn-table Construction, Eighth Convention, page 184.

7. Operating Turn-tables by Power, Eleventh Convention, page 77.

8. Roundhouse Pits, Twelfth Convention, page 220.

9. Roundhouse Doors, Fourteenth Convention.

Your committee feels that the design and construction of rectangular engine houses is now in its infancy, and we hope

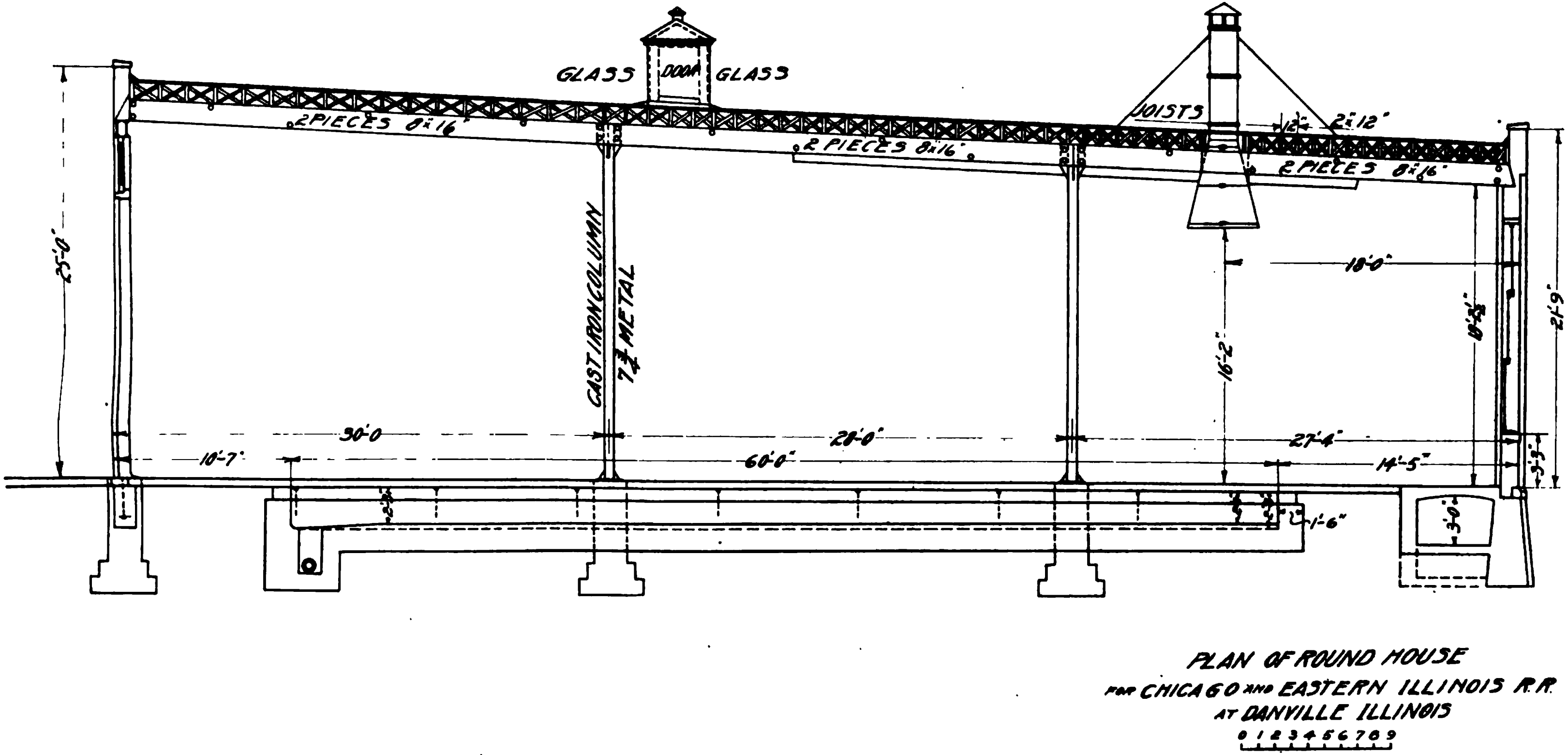


FIG. 31.—Plan of Round House, Chicago & Eastern Illinois R. R., at Danville, Illinois.

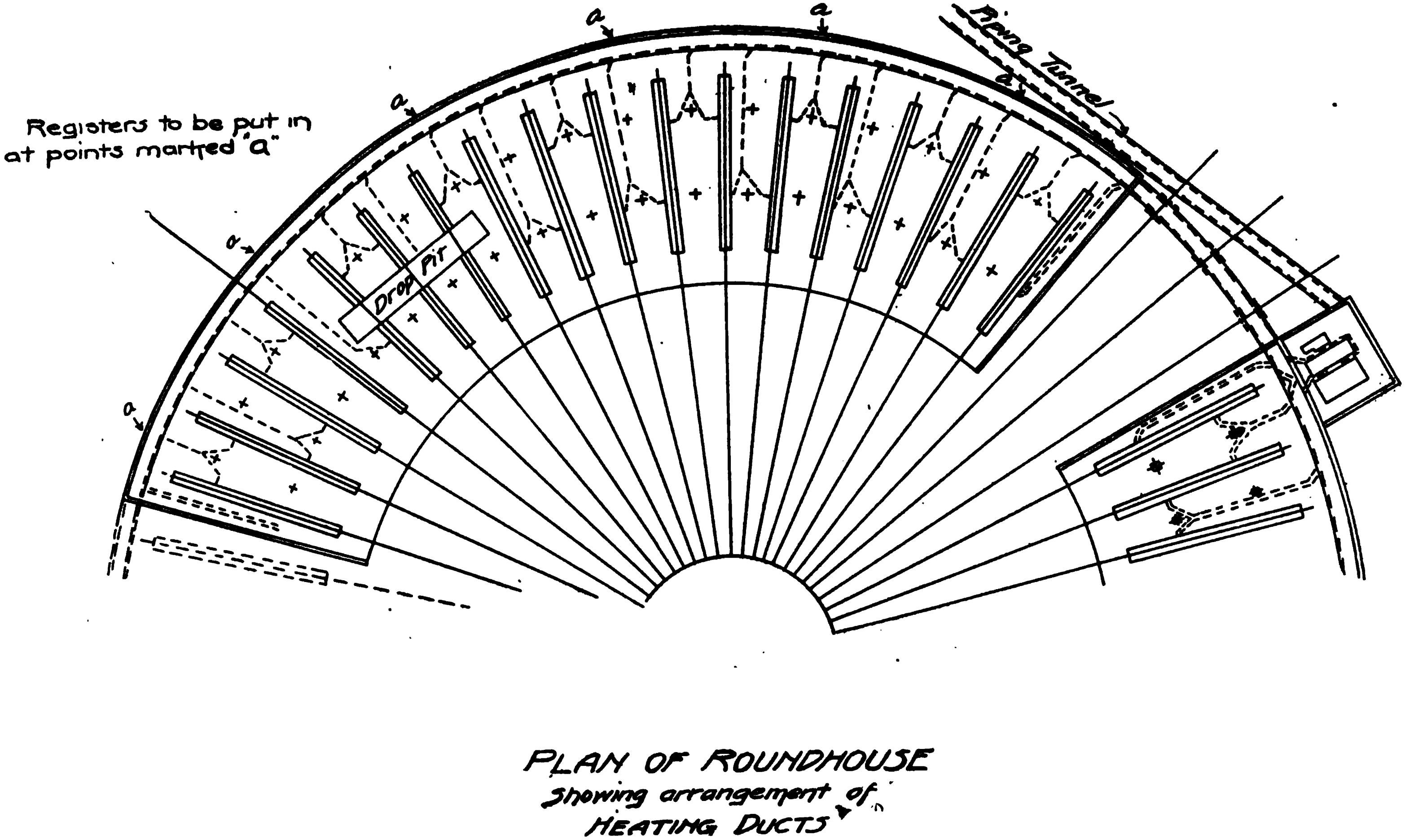


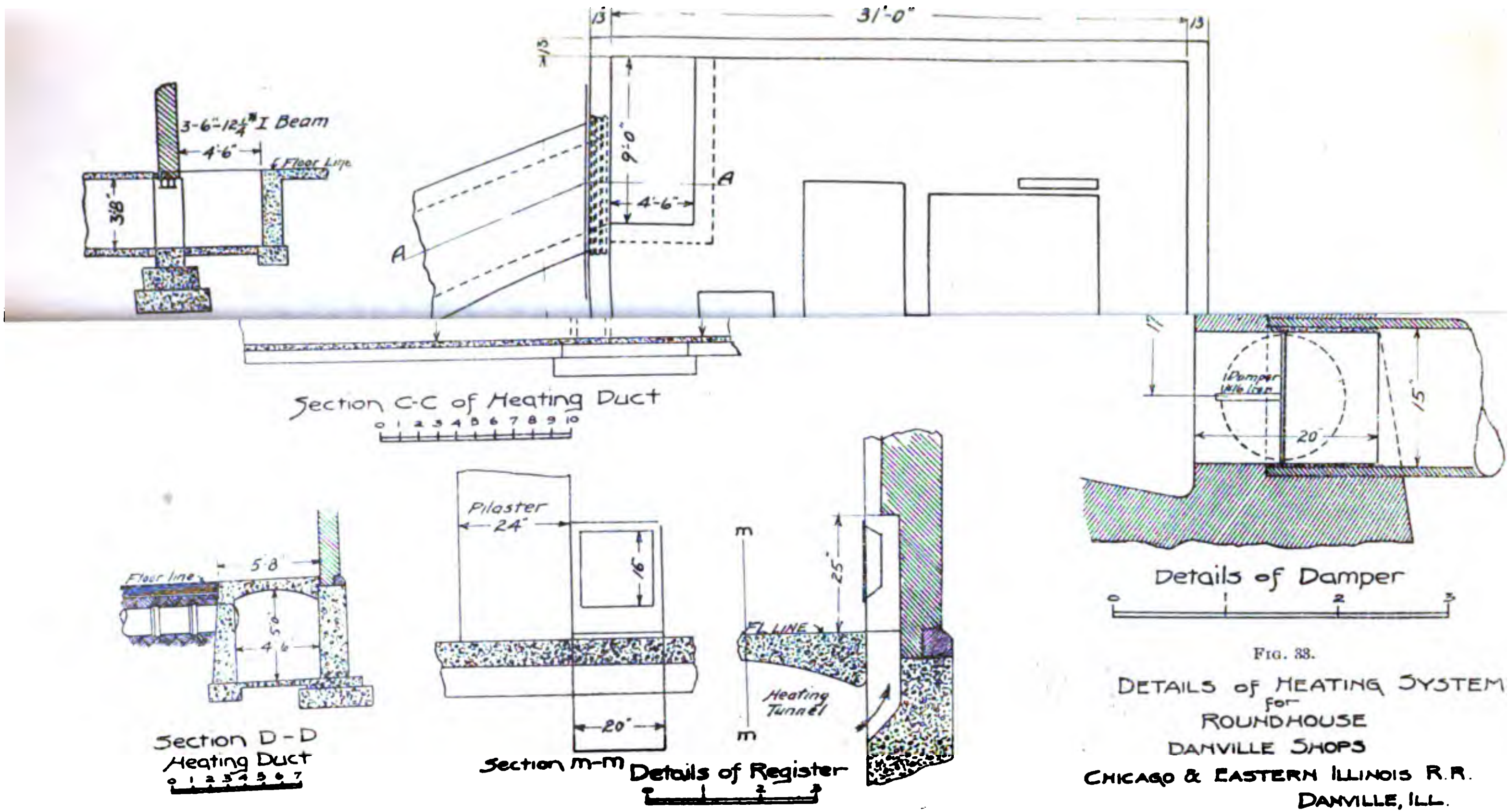
FIG. 32.—Plan of Round House, Chicago & Eastern Illinois R. R.

that our members and others who are giving attention to this type of construction may find something of interest in this report. The drawings and blue prints of circular engine houses are also worthy of careful study.

We have been greatly assisted by members and others whose names appear in the report in connection with plans or description of engine houses and we wish to thank them kindly for their interest, and, also, those whose letters appear in the appendix.

A. W. MERRICK, *Chairman*,
L. H. WHEATON,
R. L. HEFLIN,
C. W. KELLEY,
C. C. MALLARD,
A. B. MANNING,
Committee.

October 28, 1904.



31'-0"
13
3-6"-12¼# I Beam
4'-6"
Floor Line
3'8"
9'-0"
4'-6"
A
A
17
Damper 1/16 Iron
15"
20"
Section C-C of Heating Duct
0 1 2 3 4 5 6 7 8 9 10
Details of Damper
0 1 2 3
Floor line
5'8"
5'0"
4'6"
Section D-D
Heating Duct
0 1 2 3 4 5 6 7
Pilaster
24"
16"
20"
Section m-m
m
m
FL LINE
25"
Heating Tunnel
Details of Register
0 1 2 3
DETAILS OF HEATING SYSTEM
for
ROUNDHOUSE
DANVILLE SHOPS
CHICAGO & EASTERN ILLINOIS R.R.
DANVILLE, ILL.

FIG. 33.

Appendix to Report of Committee on Subject No. 4.

"Best Form of Construction for Roundhouses."

The Circular of Inquiry addressed to members and others contained the following questions:

1. Best form of engine house; whether round, rectangular, or other shape.

2. Arrangement of tracks, turn-table, or transfer table.

3. Best materials for building; whether stone, brick, frame, frame and brick, or other type of construction.

4. Any information obtainable concerning heating, pits, roof, jacks, floors, etc.

Letters and answers to these questions, in condensed form, follow.

Chicago, Sept. 9, 1904.

G. P. Nichols to C. W. Kelly, Boone, Ia.:

Dear Sir: Since meeting you at the Maintenance of Way convention in March, the subject of rectangular engine houses seems to have interested quite a number of the principal railway systems, and I have been asked so many times for an accurate estimate of the cost of constructing such a house that I have enlisted the services of Mr. W. T. Krausch, architect for the C., B. & Q. R. R., to make an exhaustive determination of the exact cost of such a house as compared with the roundhouse of usual construction, and as these figures can be depended upon, I thought possibly they might be of interest to you in connection with your report on this subject to the superintendents of bridges and buildings at their meeting, and so I take pleasure in sending you same.

I have based these figures on a 70-stall engine house, as one of the railroads is contemplating building a house of that capacity, but I have prepared the figures in such a way that they can be used for figuring out a house of any number of stalls, viz.: I have the cost of the two end walls, which are constant factors in all sizes of houses, and then the cost per pair of stalls, one on each side of the pit, which can be multiplied by the number of sections desired.

This estimate covers the complete building, brick walls, wood trusses and posts, tar and gravel roof, smoke jacks, complete heating plant, the usual wiring and fitted with electric lamps but not the generator, brick or concrete cinder pit, concrete flooring throughout, including the transfer table pit, two drop pits complete, drainage,—in fact, the house complete in every respect except the rails and cost of ground.

These figures show the cost of the two end walls to be $7,375, the cost of each pair of stalls $4,150, transfer table erected

$7,000, or a total cost of $173,775 for a complete house of 72 stalls; but as one stall will be used as the entrance, and the corresponding stall for the boilers and heating apparatus, it will net only 70 stalls.

As against this, we estimated, but less carefully, the cost of a roundhouse of the same capacity, at $2,300 per stall, amounting to $165,600, and the 75-foot turn-table with electric tractor at $7,375, which makes the total cost of the house $172,975. In the case of the rectangular house, these figures represent the actual cost of labor and material, and will hold good if the railroad company build the house themselves; but if it were built by contract, say, 10 per cent. should be added, making it net $191,152, which is slightly more than the cost of the roundhouse, but please bear in mind that the figures for the rectangular house cover the roofing of the transfer-table pit so that the entire house is under cover, whereas the roundhouse would be exposed inside of the inner walls. It is not necessary to further discuss the superiority of the rectangular form over the circular form as this was covered in my paper, a copy of which I have already sent you. I have the detailed estimate of the cost in my office, and will be pleased to show you same if you care to check up the details of cost yourself.

As regards the practicability of this form of engine house, will say that the Pere Marquette road immediately adopted this form after the publication of my paper, and have just completed a rectangular house at Grand Rapids, and have another from the same design nearly completed at St. Thomas, Ontario. Mr. Alfred, the chief engineer, and Mr. Carpenter, the vice-president, were so favorably impressed with its merits that they decided to take the initiative. However, they modified the general plan to the extent of having the engine house on one side of the transfer-table pit and the shop on the other, using the transfer table in common with both, a modification which I had in mind in working out the design.

As stated before, one of the large systems is seriously contemplating building a 70-stall house from these plans, and one of the eastern roads, we understand, has prepared their plans on this basis, as we have had a number of conferences with them and they have expressed themselves pleased with the idea.

Hoping the above will prove of interest to you, and that you will feel perfectly free to call upon me for any further information you desire, I am

Very sincerely yours,
G. D. Nichols.

A. Montzheimer, E. J. & E. Ry. Co., Joliet, Ill.:

First. While the square or English type of engine house seems to be coming into favor, I still think the roundhouse has its good points. Among them I would mention, first, engine

can be taken into and out of the house more quickly than with the square type of building; second, first cost with roundhouse is less than the cost of square house with the necessary transfer table, etc.; third, transfer table is costly to maintain and is liable to get out of order.

Second. In reference to arrangement of turn-table, I think house should be far enough away from table so in case of emergency an engine can occupy every other track between engine house and turn-table. Also tracks should be laid out so that they will match the tracks on opposite side of the table. This is very necessary when dead engines are to be moved.

Third. I prefer a brick engine house, with 12 or 16 inch walls; stalls about 84 feet long; doorways about 12 feet 6 inches in the clear, and the roof over the half of the house farthest from the table to be about 6 feet higher than the rest of the roof. This allows for the construction of windows in the side of raised part, so ample light is obtained.

Fourth. It also allows for the jacks to be built higher, thus giving ample draft. I believe in a stationary wooden jack built ten or twelve feet long longitudingly, with the track so engine can be moved without affecting the jack. A jack of this size takes in the steam dome, and in winter the house is perfectly free of smoke and steam. This style of construction does away with practically all repairs on smoke jacks. The ordinary iron jacks have to undergo extensive repairs about once a year in a house that gets constant service. Prefer hot air heaters; Sturtevant system, or something similar. Concrete pits, with iron base plate for rail bearings. Brick or concrete floors. Drop pits for taking out wheels. Roof supported on posts. Pitch of roof one inch in twelve. Good gravel roof. Do not favor a truss roof for engine house.

James McIntyre, Erie Railroad Company:

First—Round is preferable, and from an artistic point, looks better.

Second—Under some conditions, perhaps, a transfer table is best; but when an engine goes into the house for light repairs, a straight track from the center of the table to the house saves time in handling the engine in and out of the house.

Third—Brick with stone trimmings for the walls, using wood for the roof, smoke jacks, and ventilators, good white pine for posts, beams, braces, and joists. I would use the smallest amount of metal in roof possible. Pitch of roof not more than 18 inches to 100 feet. I would use two layers of ⅞-inch matched boards, and on this put four-ply built up felt with a covering of fine gravel. In the construction of smoke jacks, some have applied the board in a vertical position, applying the boards horizontally. In my experience I have found this to be a bet-

ter practice, using 2½-inch white pine for corner pieces. I would use no glass in the doors.

Fourth—In a climate where zero weather prevails, I would use steam for heating, conveyed around inside the outer wall in four lines of 3½-inch pipe and four return lines of same size, connecting each engine pit with two lines 2½-inch pipe with return pipe, with a drip and cock in each pit, all lines of pipe provided with expansion bearings.

J N. Penwell, L., E. & W. Ry., Tipton, Ind.:

First. I would prefer the rectangular shape for buildings.

Second. I have no print showing the arrangement for tracks and have nothing to offer on this particular point except that I would recommend placing the turn-table in such position that there would be from 8 to 10 inches between the rails of the two tracks approaching the turn-table. We have some where the turn-table is so far from the house that a frog is necessary on account of the rails crossing each other, and one where the rails are entirely together, holding the rails of the tracks together where they approach the turn-table. It is most satisfactory where we get 8 or 10 inches between these rails and each rail spiked to the coping entirely independent of the other.

Third. I would recommend good, solid brick walls for permanent roundhouses. Walls should also be thick and strong. I have noticed some engine houses constructed of 9-inch brick walls.

Fourth. We find that floors made of 8 or 10 inches of cinders covered with 4 inches of good limestone screenings to be the most economical and practical floor we can put in. In building floors of this kind we bed a stick of timber 6x16 on the outside and parallel with each rail. For smoke-jacks I believe I have found nothing as yet that I consider equal to the Paul Dickinson cast-iron jack. We are using Pickering smoke-jacks which are said to be fireproof if kept properly painted, but my experience is, that if we use combustible material we will have fires sooner or later. There are quite a number of wooden jacks now in use that are light and seem to answer all practical purposes, but as these jacks grow older fires will surely occur. As for heating the pits in roundhouses, we find that a coil of steam pipe placed on either side of the pit and hung on iron hooks would be the best thing we have been able to secure. The only trouble we have experienced with the steam heating arrangement has been on account of the men on two or three occasions allowing the pipes to freeze.

T. C. Burpee, Intercolonial Railway of Canada, Moncton, N. B.:

First. I believe roundhouse to be the best shape.

Second. Round engine house must have turn-table in front, by which means engines can be turned in any direction, which to my mind is the objection to transfer table in connection with rectangular engine house.

Third. Stone, if non-destructible by fire, brick or concrete.

Heating. For system of hot-air heating, hot-air pipes leading into sides of pits through vitrified clay pipes.

Roof. Inverted roof to be covered with some fireproof material, containing as little weight consistent with durability as possible. Sparham roofing is admirable for this purpose, both on account of its light weight and fireproof qualities.

Jack. Telescope jack to work with lever.

Floors. Floors to be of cement if it can be afforded.

I would refer you to cuts and description of roundhouse, Intercolonial Railway of Canada, in the *Railway Review* of the 12th of March, 1904.

A. E. Patton, Grand Trunk Railway System, Montreal, Canada:

I consider, to facilitate the handling of engines at terminals with comparative ease and dispatch, the round form of engine house with turn-table in the centre is preferable to any other form, as it permits engines that are required to be taken out and others replaced in stalls without interference to others which are on pits undergoing temporary repairs. Have all engines head into engine house, which is an advantage for the hostler in placing his engine; also an advantage for workmen doing repairs, as it brings the work up to the windows instead of using artificial light. I think brick the most satisfactory material to use in construction of engine houses, although we are now constructing two of concrete. These no doubt will estimate a little less in cost compared with brick, but I would prefer the brick for many reasons; the main one to simplify repair in the event of a mishap such as an engine going through the wall which has happened frequently.

Regarding the engine pit; a very nice pit may be made of concrete, and can certainly be put in place with cheap labor and answers the purpose equally as well as brick. Our standard is 60 feet long, 2 feet 9 inches deep at drainage end, and 2 feet 3 inches at top end, planked with 6-inch dressed planking. It is not a good feature to have engine pits in shop too deep, as the work under engines is beyond the reach of workman without the use of blocks in pits to stand on.

The tar and gravel roof when properly applied makes a very satisfactory roof for the round form of engine house. In regard to floor between pits and at front end where benches are placed

I consider the cement floor the most economical owing to its long life, and it is certainly the most sanitary owing to its cleanliness.

The wooden jack is giving the most satisfactory results of any jack which has been in use as yet, that is, for outside of roof with the wrought-iron drop-hood attachment inside, and makes a nice conveyor of smoke from engine stack.

The heating of shop to be confined to pits providing same with a complete 1¼-inch four-pipe coil on two sides and one end taking feed and return from low end of pit conveying all returns to a main up against wall, which is placed in an opening lower than pits, accessible at all times and merely covered with plate; this comes under benches and is out of the way; this return main carries all condensation back to one common hot-water well which is pumped back into heater boilers or used for washing out locomotive boilers. We are now installing hot water for heating shops, which is heated in a hot-water well, with exhaust steam and forced through piping with a pump, but consider, myself, steam the more satisfactory for heating, as engines coming in covered with ice and snow require to be thawed as quickly as possible, and I think are equally as economical.

I am enclosing you blue prints of our engine house at Island Pond, Vt., and if there are any features or details you would wish me to cover more fully I will gladly do so.

G. W. Smith, American Bridge Company, Chicago, Ill.:

First. The best form of engine house containing three or more stalls is probably round, although various designs have been made for rectangular houses with transfer tables or other schemes for gaining access to the building. Although good arguments may be given for other forms of houses in special cases, the prevalence of the roundhouse proves with good evidence that it represents the best form under usual conditions.

Second. The location of the house ought to be where there is sufficient room to permit the construction of clinker pits and the necessary devices for supplying the engines with coal, water, and sand. Provision for all these elements of service cannot be made without a liberal allowance of space on which to distribute the engines as they arrive, without interfering with the convenient egress of engines from the house which are going into service.

The economical handling of waste material out of the clinker pits and the proper drainage of the turn-table and roundhouse pits can best be accomplished by having the plane of the roundhouse tracks considerably higher than that of the tracks in the yard adjoining. This is a point which receives too little consideration, probably for the reason that the cost of construction would be increased.

Third. The best material for use in the construction of engine houses, assuming that they are of sufficient importance to warrant construction which is partially permanent, seems to be brick walls, wooden framework, and gravel roof. When I say best I mean the kind of materials which will give the best results with the greatest economy. If the fire risk incident to wooden framework is objectionable, steel columns and purlins may be easily substituted.

Fourth. I am unable to offer any points of value in regard to the items mentioned under this number, except that I believe in laying track rails on a permanent wall instead of a 12x12 longitudinal sill. I am also a believer in the low flat roof, wooden jacks, and brick floors.

My experience was entirely with the Chicago, Milwaukee & St. Paul Railway, and I assume you will get drawings indicating their present types of construction from some of our members who are now in their employ.

J. P. Snow, Boston & Maine Railway, Boston, Mass.:

Regarding engine house construction, I send you drawings of the style of brick house that the Boston & Maine Railway is now building. Practically the same style of building is built of wood, with outside clapboarded, when occasion requires.

The plan shows a complete circle. This, of course, is seldom built, but the same style is used for segmental houses. We frequently build them so that there will be no frogs in the rails, placing the house just far enough from the pit so that the outside of the rails will touch.

Our experience proves that the posts between pits are no obstruction. I do not think that four posts would be at all in the way, and with houses deeper than 75 feet four posts would make a cheaper house than three. A flat roof is preferred to a pitch roof, as it requires less timber in the frame; it discharges all rain water at the rear of the house, where gutters and conductors are not needed, and the covering requires less nailing than a steep roof. This latter is important, as common nails will not answer for securing the covering of engine house roofs.

The floor is brick, laid flat, and grouted with cement. The pits are shown built with brick, although concrete is sometimes used and is just as good. The timbers under the rails are treated with a preservative wash. The stick outside of the rails is designed for setting jacks upon, and they give good satisfaction.

The water supply is carried under ground and brought to the middle post in every second bay where a hose outlet is provided. The heating pipes are placed in every second pit. The inlet steam pipe runs from the front interior post, where it connects

with a pipe running overhead across all the pits. This main can be connected to a locomotive or a stationary boiler as desired.

The smoke-jacks are the Pickering wooden jack with some modifications to allow of better flashing. The ventilators are designed to carry away the steam. In winter they carry away so much heat that we generally provide shutters so that they can be closed in cold weather.

The front columns are built of Z bars. With doors 3¾ inches thick, opening inward, they occupy a width of 10 inches, the clear opening being 11 feet. The doors are hung on three hinges and one door of each pair is secured when shut by sliding bolts and top and bottom. Formerly we interlocked these bolts so that one motion of a lever sent both home. It was found, however, to be very difficult to set both top and bottom exactly right at the same time for the bolts to enter. The arrangement shown works much better. When open the doors are hooked to a post set in the floor for this purpose.

The turn-table at the house shown on the general plan is operated by a gasoline motor.

G. W. Aldrich and H. K. Higgins, N. Y., N. H. & H. R. Ry.:

First. The rectangular form of engine house seems to us the best adapted to the requirements of modern railways. The economy in roofing and space occupied much more than compensates for the planning required to get the engines placed in proper order. The strongest reason, perhaps, for favoring such a departure from the accepted round type is found in the familiar situation,—turn-table broken down, all the locomotives on the division tied up, or the equally familiar breakdown of turntable on account of fire in the roundhouse. The stalls should be deep enough to hold not more than four locomotives per track.

Second. When land is cheap and available the engine house should be approached by tracks with switches. Where land is not available a transfer track is preferable. It is much less liable to break down than a turn-table, and when repairs are necessary they can easily be made without sending away for parts. A turn-table or "Y" must of course be provided, but that will occupy only a small fraction of the room wasted in a roundhouse.

Third. Floors of roundhouses were in the olden days usually paved with brick. If properly put in, with a concrete base and laid with paving brick, this forms an ideal floor for the varied service required. Concrete floors are good if properly designed and built. They are almost always too thin and give less service than might reasonably be demanded. The walls should be of brick or concrete. Door posts and lintels should be of steel,

built into the walls and filled with concrete. Steel should not be used anywhere in an engine house unless covered with cement. Roofs have heretofore been of steel and of wood Steel rusts badly and is consequently unsafe. The sulphurous acid and steam renders paint worthless and impossible of satisfactory application. The ideal roof would appear to be some form of reinforced concrete, supported by reinforced concrete columns. This is of course costly, but should pay in the long run. Wood lasts better than iron, but even then it is seriously affected by the acid and steam. Oak and hard pine of a very high grade when put in place over a busy engine house, could be crushed between the fingers after some years' service.

Fourth. Heating should be by some indirect system. Power-driven fans should deliver the warmed air through underground ducts to the pits. The heating system should be generous. Time lost thawing out engines with torches and steam jets will more than pay for the requisite heating plant. Pits should be made of brick or concrete, preferably the latter. The rails should be bedded in concrete or set on cast shoes built into the brick walls; rails should be fastened to anchor bolts set into the masonry or concrete, bent to fit holes in web of rail and provided with nuts both sides of rail. Pit floors should be arched to give dry footing, and should be deep enough to allow a man to stand upright when working under the engine. They should of course pitch toward end or middle and drain into a pit with proper drain pipe properly tapped. Jacks or ventilators are not yet made to really fill the bill. Probably the best are of cement pipe, and next best vitrified clay pipe. Wooden flues have been used since very ancient times, and if kept well covered with fireproof paint and sand, are very efficient for the money they cost. If not kept up, they are of course dangerous.

H. M. Henson, Chesapeake & Nashville Railway, Gallatin, Tenn.:

In answer to your circular letter, Subject No. 4, "Best Forms for Construction of Engine Houses."

First. Round.

Second. Turn-table.

Third. Stone or concrete.

Fourth. Cast-iron smoke jacks, concrete pits and floors, slate roof.

M. Riney, C. & N. W. Ry., Baraboo, Wis.:

First. Rectangular.

Second. Transfer and turn-table combined.

Third. Best material for building; brick, and stone foundation.

Fourth. Hot air for heat; floors paved with old bridge timber sawed 8 inches long, with foundation of sand and cinders; all joints to be sanded and tarred; wood jacks.

C. W. Kelly, C. & N. W. Ry., Boone, Ia.:

As almost all our engine houses are of circular type, placed entirely too close to the turn-table, the growth of our engines is constantly making them larger, which makes the doors inadequate to clear the engines on going into the house. The close proximity to the table compels one to throw the doors open before leaving the table. The close proximity also makes the radius so short that there is no pilaster left between the door. For this and many other reasons, I am almost converted to the idea that a rectangular engine house, with a transfer table, is perhaps the most economical and the most desirable.

J. W. McCormack, C., St. P., M. & O. Ry., Altoona, Wis.:

Answering your circular, Subject No. 4, of April 18, 1904.

First. Rectangular.

Second. Location and amount of work to be done governs this question.

Third. Concrete stone. However, this depends upon material available and cost of same.

Fourth. Hot air. Concrete pits. Pitch and gravel roof, if roof is not more than two inches to the foot; if more than that, some prepared roofing. Drop jacks. Concrete floor.

L. H. Wheaton, Halifax & S. W. Ry., Bridgewater, N. S.:

For small systems and new roads in territory where traffic is yet largely to be developed, I prefer circular engine houses with sufficient stalls for motive power required for existing traffic and new stalls to be added as circumstances require. Buildings to be of brick with timber roofs (graveled) and wooden smoke-jacks.

J. O. Thorn, C., B. & Q. Ry., Beardstown, Ill.:

I have your circular pertaining to subject No. 4. In reply, will say that where ground space is available, I am in favor of rectangular engine houses, and an arrangement of track entrance to be from the side. Engines can stand at an angle if desired. Next to this, would prefer a roundhouse with not less than a 40-stall circle and 60 stalls would be better. I prefer turn-table 72 or 80 feet. I am not in favor of transfer table, especially north of the south line of Missouri.

Where good stone can be had cheap would not object to it,—would, however, prefer a good soft mud brick laid in cement mortar where good brick clay can be found convenient and cheap. Hauling long distance and repeated handling can be avoided, and equally as good or a better house produced with concrete blocks, and in many locations this can be done for less money than the cost of brick or stone. I am opposed to any style of wood construction for engine houses, except for roof girders and columns, which should be thoroughly salt treated. Roof covering for best houses should be of concrete steel, treated on top surface with soap and alum process. The cheaper construction use rubberoid or some sort of felt roofing. I have no use for coal tar on an engine house.

Smoke-jacks? I give it up. I have never found one that was, or is, satisfactory. Foundations for buildings, columns and pits; concrete is especially adapted, nor would I object to the entire pit being made of concrete; also, the sewer. Pit walls should be made wide part of their length, at least a number of stalls should be so made for jacking up engines. Personally, I should prefer to make all the pits so that the engines could be jacked up on them.

Floors. Vitrified brick is the best I know of. Engine houses should be made deep enough to permit of hanging the doors inside; no door should be hung on the outside or to swing out. A good fastener should be put on to hold all doors firm at top and bottom. Roof girders should be strong enough to lift considerable weight in addition to weight of roof.

L. D. Smith, G., C. & S. F. Ry., Galveston, Texas.

Complying with request in your circular of April 18, I am sending you under separate cover the following list of prints, covering our proposed standard engine house: *

65–5,016. General plan showing Southern type engine house, addition to old frame engine house, with standard 60x100 machine shop, as arranged for Silsbee, Texas.

65-5,000, 5,011. Standard Southern type engine house.

65-5,019. Opening in rear wall, Southern type engine house, to machine shop and drop pit for engine drivers and truck wheels.

These plans cover our proposed standard Southern type engine house. By the term Southern type we refer to houses to be built in south Texas or in warm climate where it is possible to obtain good ventilation, from a continuous louver ventilator in roof, thereby avoiding the use of smoke-jacks.

65–5,052. Cross section of our proposed standard Northern type engine house.

This is really a preliminary drawing, gotten up to show the proposed construction. In this plan you will note that the rear

*Prints not reproduced.

wall is not as high as in the Southern type, and a flat roof is used over the last span, instead of a pitched roof. Also, smoke-jacks are provided for engines and stoves for heating. The estimated cost per stall for both types is $1,200. This includes water, steam, air, and blow-off pipes; vitrified brick floor, clothes' lockers, and work benches, but does not include the heating.

Question 1. I am inclined to favor the circular form of engine houses for general use, and would not recommend the use of rectangular engine house, where a transfer table would be required in addition to turn-table at division points. However, the rectangular houses could be used to good advantage in connection with a large general shop.

Question 2. The arrangement of the tracks depends largely on location or the arrangement of the yards. With engine house plan, I enclose a print of our Cleburn station plat, showing the arrangement of the tracks communicating with engine house. This is a typical arrangement on this line, and has given satisfaction.

Question 3. The term "Best Material for Building" is rather hard to define or agree upon, as local conditions and experience in localities widely separated make it a matter of local decision, usually based upon economical construction. On this line we have used rubble masonry, with wooden posts and roof construction with fair success, from a low original first cost and economical maintenance. Not having had experience with fireproof construction, I am not in position to give an opinion, further than that the estimates made show an increase of nearly 75 per cent. in first cost, and conditions prevailing at the present time would prohibit its use.

The following list of prices on material placed in building are an average of what our engine houses have cost, and will give you an idea of the prices prevailing in Texas:

Earth excavation, per cu. yd.	$0.45
Concrete foundation, per cu. yd.	4.50
Rubble masonry foundation, per cu. yd.	5.00
Rubble masonry above water table, per cu. yd.	7.00
Window caps, per lin. ft.	1.25
Window sills, per lin. ft.	1.25
Door caps, per lin. ft.	1.25
Post plinths, each	1.75
Truss seats, each	2.50
Concrete floor, 5 inches thick, sq. yd.	2.00
Brick paving, per sq. yd.	1.25
Water table, per lin ft.	.90
Lumber placed in building, per M ft., BM	26.00

Question 4. I strongly favor the fan system of hot-air heating, through a system of pipes with outlets in engine pits. For

roof, I favor mill construction, as shown on plan submitted. As to smoke-jacks, although none are perfect, we have found that the cast-iron swinging smoke-jack, with lever-arm attachment, has given the most satisfactory results. For floor, I favor vitrified brick, laid on edge, with sufficient crown between pits to provide good drainage.

You will note on cross section of these plans space is provided for placing traveling crane, supported on rear wall, and the last roof support post. Up to the present time we have not installed any of these cranes, but expect to do so in the future.

There are a few points which I hope the committee will arrive at a conclusion upon, and that is the best location for blow-off pipes, water, steam, and air pipes. The plans submitted show the steam, air, and blow-off pipes located in the ring pit, with branch lines to last post between alternate stalls, with cast-iron water main buried between the rear wall and the end of the engine pit. It is proposed on this line to place the blow-off pipes overhead, with a flexible joint on branch pipes to connection with blow-off cock on steam dome, but think the best location for the steam and air pipes is in the ring pit.

F. P. Gutelius, Canadian Pacific Ry., Montreal, Canada:

I hand you herewith complete set of blue prints showing the character of the concrete and steel engine houses which we have been constructing during the past year.

The special feature in connection with these buildings is the reinforced concrete roof and the fact that all steel work in these buildings is protected by concrete from the effect of gases.

We are of the opinion that the circular house with turn-table in the centre is the most economical shape for an engine house.

The best materials for engine house construction depend largely upon the climate. We have found that the hardest burnt bricks fail in our engine houses along the north shore of Lake Superior; in consequence, we are using stone in our new construction at these points.

We are very much pleased with the results of a complete gravel concrete engine house constructed last year in accordance with our standard plans at Moose Jaw. Its cost was less than brick or stone.

In the matter of heating, we use the Sturtevant hot-air system plant, air ducts placed beneath the floor as shown on plans.

Our method of fastening the pit rails to the pits is by means of forged plates set in the metal to which the rail is bolted.

The roof, as explained above, is reinforced concrete, covered with plastic ashphalt; cast-iron jacks, and brick floors.

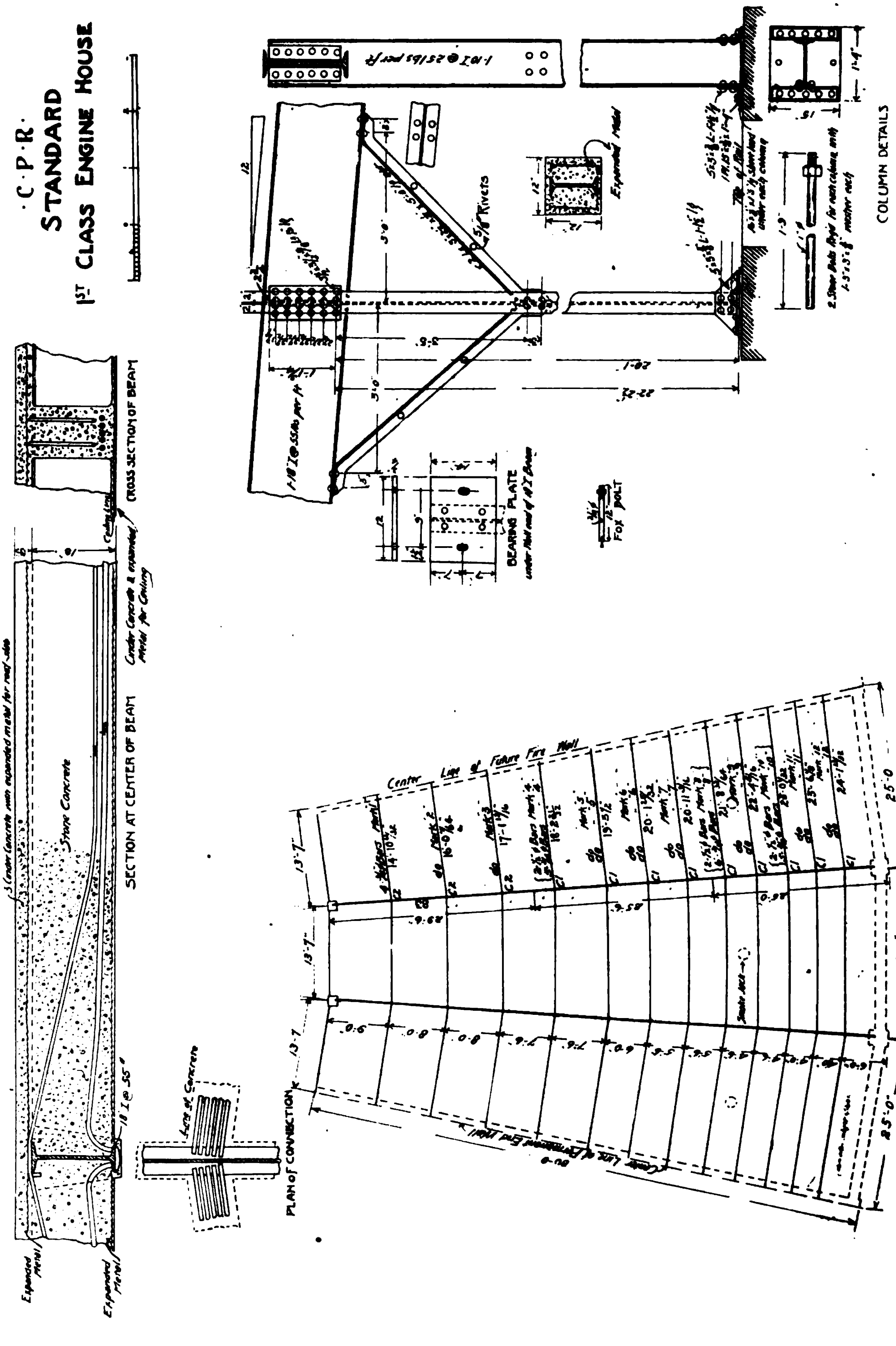


FIG. 84.—Standard First Class Engine House, C. P. R. R.

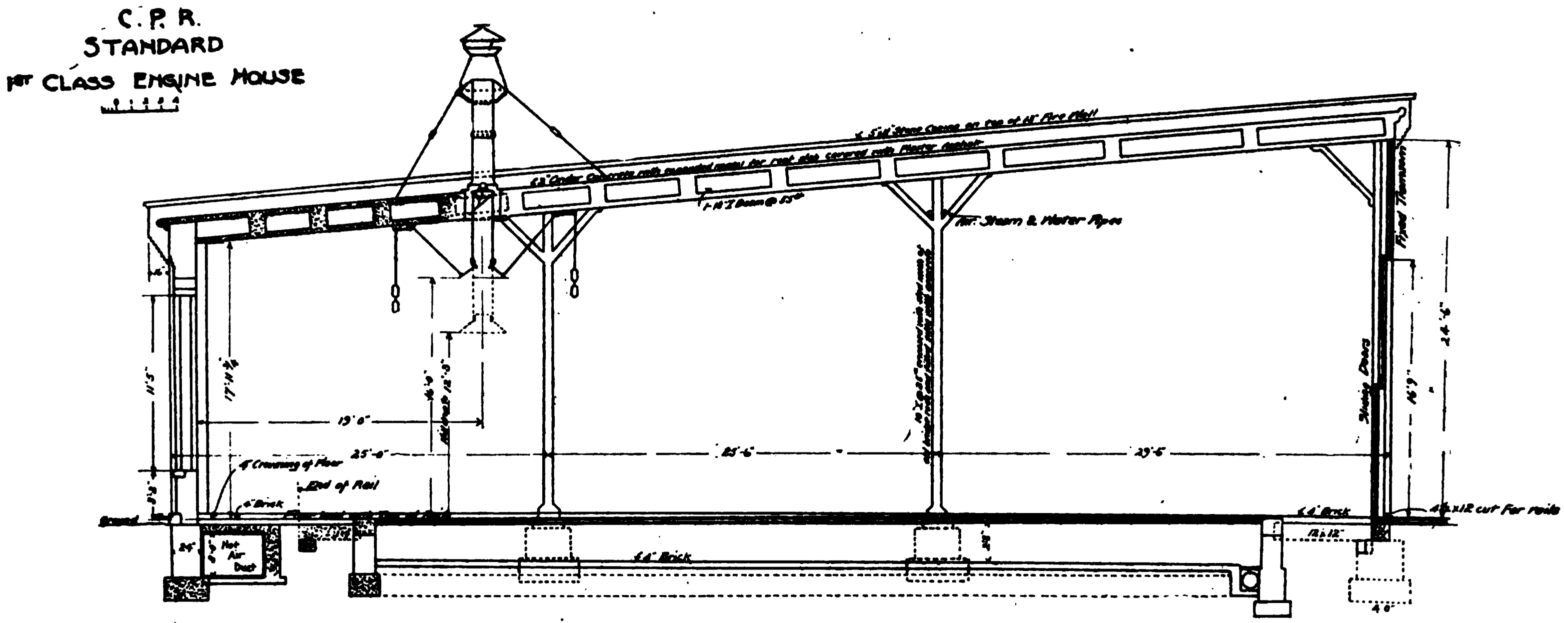


Fig. 35.—Standard First Class Engine House, C. P. R. R.

DISCUSSION.

Mr. G. W. Andrews.—I think that most of the members here, especially those who have had to do with the designing of roundhouses, will agree with me that it is a very difficult thing to say which is the best form of engine house. I think also that you will all agree with me when I say that the best form is the personal opinion of the general manager or the chief engineer. The chief engineer, with most of the roads, will get a small location plan and pass it along to the superintendent of bridges and buildings. He will confer with the general superintendent of motive power or his superintendent, or some person in charge of the mechanical department, and find out from them what they want in the for mof an engine house. After a conference of three or four days he will go back to his office and begin preparation of plans, thinking that he has made a good start. After a week or ten days he turns in his plans and if they are returned with any of the original lines in them he will be surprised. They will be returned so marked up that he will have difficulty in recognizing his original work, and for that reason I think it is impossible to decide what is best. We can determine what is good, but we can never make it a standard in our work. Personally, I think the best form is the circular form, if you have a large number of engines. If you have a small number of engines, perhaps the oblong or parallelogram form is best. As to the character of construction, that is also a question that has to be taken up and, after you have decided what you want, brick, concrete or stone, you go ahead and get your foundations in. Then there is a change of administration and they will want some other kind of a house. Laying all that aside, I would say that the roundhouse is generally the best form, and a good standard is to erect a frame house on a concrete foundation, with vitrified brick floor and concrete or vitrified brick pits, a pit to every stall, at least one driver-wheel pit to every ten stalls, and two (and not less than two) truck-wheel pits.

The design of the house itself, or superstructure, is more governed by local conditions than anything else. After getting that in, our first problem is to get plenty of light. We have built quite a few different styles and incidentally succeeded in pleasing nobody. We have, I think, put up some very good houses, and we put them up in that character of construction. We have heated the houses with the fan system and have used the underground ducts almost exclusively in roundhouses. That is, we carry an underground duct through and under the outer circle, supplying air to the pits by means of intermediate ducts leading into alternate stalls and branching off on each side of the pit.. The steam and hot and cold water pipes are placed overhead with apparently good results. We have also attached to these roundhouses a blow-off system. That is, we have connected up with each pit running up from the center to the intermediate pits a two and a half inch pipe, at which point it connects with a four-inch pipe, which in turn connects with a six-inch pipe running into a well, which consists of a slushing tank and well into which the water and grease are blown. The heavy matter settles to the bottom and the clear water overflows and goes into the settling tank, holding about 50,000 to 75,000 gallons. By using a system of this character we eliminate almost entirely the vapors that are constantly gathering in the house from the blowing off of boilers into open pits. I think that this is one of the best attachments that can be placed in a roundhouse and I think all modern roundhouses should have it. They are expensive probably, but they pay for themselves in a short while in wear and tear on pits and floors and, what is more important, in the health of the employees in roundhouses. We have covered our roundhouses with various kinds of roof, but principally with timbers resting upon columns, upon which are placed the ordinary lines of purlins three to three and one half feet apart, covered with one and one half inch tongue and grooved sheathing. That is covered with gravel or ready prepared

roofing, of which there are many kinds in the market. Our jacks have cast-iron telescopic and swinging ends. Our doors—I think I explained this morning—are square head doors with the fastenings mentioned at that time. The size of the house is 90 feet, which is long enough for the longest locomotives that we have today and probably will have for future generations. Our houses are also supplied with a track running around the outer circle on which is run a small truck for the conveying of heavy castings or heavy pieces of machinery from the machine shop. At the point of contact between the roundhouse and machine shop is a small turn-table. When you get orders to build a roundhouse, try as hard as you can to get the opinions of the people who have to handle it; get their ideas as to the best method of designing a house and get it in writing; that is, when your plans are ready for approval, get their signature. Unless you do, there will be a question come up in a very short while as to who is responsible for certain changes.

Mr. A. S. Markley.—I should like to ask Mr. Andrews if the boiler washings are run into this settling basin and if the water accumulating in this basin is pumped back and used again?

Mr. G. W. Andrews.—The boilers are blown off through this piping. The washings go into the slushing well and settle to the bottom, then pass off through a sewer. There is a valve with a handle on it at the top of the well, which can be operated at any time desired by the man in charge. The clear water going to the top overflows and goes into a settling tank, and that water is used over again. That is the object of the settling tank; to get water that is warm.

Mr. A. S. Markley.—The reason I ask is that at our shops we empty our sewers directly out into a stream and now the people below us say that we are polluting the water, which is true. In order to overcome this we are going to build a double settling basin with a filter located between them of gravel or slag or cinders.

I am inclined to favor the square engine house, and be-

lieve that if it is built in two sections, one each side of transfer table, leaving both ends open next to transfer-table, and enclosing all under one roof, there would be a great many advantages in it over the round engine house. With a square engine house we could extend it as far as desired.

Mr. G. W. Andrews.—Are you going to use cranes for transferring locomotives that may be in the middle of the house and ready for use over those that are at the end of the house? If you have an oblong house with two or three tracks, you may sometimes have engines in the middle of the house that you want to get out and engines at the end that you cannot move.

Mr. A. S. Markley.—A transfer-table could be put between the houses. That same difficulty occurs in a machine shop. Some roads have a long track from one end of their machine shop to the other. If the work on an engine in the center of the track is completed, they have to hoist it out with the crane. With the plan I have in mind, an independent stall for each engine, you could get an engine out at any time without disturbing any other or using the crane, having the track lead to the transfer-table.

Mr. G. W. Andrews.—You could not accomplish the work in the same time that you do in a roundhouse. The turntables in modern shops are operated by power, either indirect steam or electric, and you can get an engine in or out in a very short time, much better than you could possibly do with a transfer-table. That is one of my principal reasons for preferring a roundhouse.

Mr. R. H. Reid.—In connection with the transfer-table, I would like to ask what provision is made for a turn-table? Do you use a Y or a turn-table?

Mr. Finley.—Make a turn-table out of the transfer-table; turn it at one point, say the middle of the house.

Mr. Schall.—I doubt if the square engine house is as economical as the round. The roundhouse can be built in the smallest space and it is the space which you occupy that is very important for the operation of an engine

house. Very often you would not have the ground on which to build a square engine house. I built a square engine house in 1884 with a yard at each end. It was double-ended, had 22 stalls; the house was not entirely satisfactory.

Mr. A. S. Markley.—It would depend, of course, on the number of stalls. We have a house with 54 stalls but find it will not be large enough. What are we going to do?

It is claimed that the round engine house is the most economical in ground area. I cannot agree. With a round house the turn-table is placed 80 feet from the engine house. The end of a transfer-table can terminate at the end of the doors when open. All the space needed for an engine is the center width of the stall, which would be 16 feet or possibly 18 feet. On the back end of the roundhouse there is a width of 26 or 28 feet and in front 14 feet per stall. For the same ground area I venture to say that less ground is occupied with the square than with the round engine house. Of course in a modern plant of this kind the transfer-table should be handled by electricity.

Mr. Finley.—I do not see where there would be any difficulty in making a transfer-table so that it could be turned at the point where the engine was sent out of the house. There is no mechanical difficulty in making a traveling turntable.

Mr. Sheldon.—It appears to me that you will need a turn-table to get engines headed right, and, while you may be able to store more locomotives in a rectangular house than a roundhouse of equal area, the additional room required for a transfer-table offsets this, and, besides, the transfer table is slow, and where a large number of engines are handled time is an important factor.

Mr. Killam.—I would like to ask Mr. Markley what the cost of a transfer-table would be as compared with a turntable?

Mr. A. S. Markley.—I do not believe that a 75-foot trans-

fer-table would cost as much as a 75-foot turn-table. Approximately it would cost about $5,000.

Mr. G. W. Andrews.—That is less than one half what a turn-table costs and I question your figures. We do not wish to be placed in the position that we were at Kansas City. At that place we had the pleasure of having Mr. McGuigan with us for a few days. Just before we adjourned, I, as president at that time, asked Mr. McGuigan if he would not give us his opinion of our Association as a body of railroad men, and he did so to the great amusement of many of us. He stated that in the three days that he had been with us he had received much information of which he had hitherto been ignorant, and that he had also been very much amused. One of the points that he brought up was that in the Convention we could do the work so very, very cheap, while in the field it cost so very much. We want to avoid that. We do not want to say here that we can put in bridge iron for $5 per ton when it will cost us more. We do not want to say that we can build a transfer-table with power for about half what it would cost. I think that when we get down to the actual cost of a transfer-table there would be very little difference, if any, between it and the cost of a modern 80-foot turn-table equipped with power. We have installed a large number of turn-tables and we have not been able to get them under $6,500, including everything.

Mr. A. S. Markley.—Another thing that would increase the cost of a transfer-table beyond that of a turn-table. It is necessary to make the transfer-table the full length of the house.

Mr. Killam.—I have looked over the drawings and report quite carefully, and I may say that this question comes within range with what we have at Moncton. We have one roundhouse with 35 stalls and turn-table. A track runs through this roundhouse to another of smaller size, 25 stalls, and from there into the erecting shop. In the middle of this erecting shop is a transfer-table, the shop being 200 feet

long with a set of stalls on either side for repairs to locomotives. The transfer-table has cost fully as much as three turn-tables could have. It is of the very best type I believe that can be constructed. Beyond this is the general erecting shop. Locomotives pass through this transfer-table and out into the roundhouse, where a square house, such as mentioned here, would cost more than double the money, as far as we are concerned. The transfer-table would cost about three times as much as the turn-table.

Mr. Schall.—I wish to ask Mr. Markley what he meant by a $5,000 turn-table?

Mr. A. S. Markley.—I have some figures for a rectangular house which show the cost of the two end walls to be $7,375; the cost of each pair of stalls, $4,150; transfer-table erected, $7,000, or a total cost of $173,775 for a complete house of 72 stalls; but as one stall will be used as the entrance and the corresponding stall for the boilers and heating apparatus, it will net only 70 stalls. As against this we estimated, but less carefully, the cost of a roundhouse of the same capacity, at $2,300 per stall, amounting to $165,600, and the 75-foot turn-table with electric tractor at $7,375, which makes the total cost of the house, $172,975. In the case of the rectangular house, these figures represent the actual cost of the labor and material, and will hold good if the railroad companies build the house themselves.

Mr. Schall.—If you take for example a house of 54 stalls, that will give you 27 stalls on each side and, figuring each stall at 14 feet, you would have to have a house about 390 feet long. A transfer-table would have two end bearings and two intermediate bearings, or four bearings in all. I think a turn-table is more economical. A turn-table, complete and with power, costs $7,500. An electric transfer-table for a house of that character will cost at least $15,000 to $20,000, if built right.

Mr. Reid.—It seems that if a turn-table is necessary it would be better to use a roundhouse rather than a square house with a turn-table or Y in connection with the trans-

fer-table, as the turning and the transfer arrangements would both be necessary. There is one point in favor of the square engine house and that is that in case of fire all the engines could be run out of the house so as to leave them practically safe, while in the roundhouse the tracks converge at the table and the engines could not all be run out.

Mr. A. S. Markley.—You are losing sight of the point I make—that where it is necessary to have two engine houses, it is cheaper to build the square house.

Mr. G. W. Andrews.—I do not want to say that the square engine house is not practical. My point is that the round engine house is the most economical after it is completed. The question of time is very important with the motive power department, and we can certainly handle an engine from a round engine house much more quickly than from a square house with a transfer-table. When an engine goes into the house it passes over the ash pit; then as it goes out it takes water and runs over to the coaling station to coal up. Both in entering and leaving the house it crosses the turn-table. These operations can be accomplished more quickly and economically with a roundhouse than with a square house. The question of economy is that of operation, not a question of the first cost of the house.

Walter G. Berg (written discussion).—In connection with the report of the committee on "Best Forms of Construction for Engine Houses," I note that the committee, in reviewing previous publications and published references to square engine houses, has omitted to call attention to the article by our esteemed member, Mr. John D. Isaacs, Assistant Engineer, Maintenance of Way, Southern Pacific Company, San Francisco, Cal., consisting of a paper by Mr. Isaacs, read before the Pacific Coast Railway Club at their meeting at Los Angeles, Cal., on October 20, 1900, published in issue No. 6, volume No. 2, of the Official Proceedings of the Pacific Coast Railway Club in 1900.

This article and accompanying illustrations cover practically the same ground as a paper by Mr. George P. Nichols, presented last winter to the Western Railway Club of Chicago, which paper is referred to and quoted in part by the committee.

Mr. Isaacs' paper of October 20, 1900, is as follows:

"It seems to the writer that limiting the question to cost of construction, manner of lighting and facilities for repairing engines, restricts the range of the subject somewhat unnecessarily. This paper, therefore, will touch, not only upon these points, but upon others germane to the subject. Some consideration must be given as well to the land occupied, facility for ready extension of the building, maintenance of tracks and turn-table, convenience for extending tracks through building to adjoining shops, etc.

"The circular engine house is expensive to build. The spacing between the tracks is, of necessity, restricted too much on the inner and is unnecessarily wide on the outer side. In the matter of construction, the framing, if of steel, is complicated and expensive; overhead traveling cranes for handling cabs or the lighter parts of the locomotives are inadmissible; extensions to a permanent structure are troublesome to make; and while a complete circular building is possible, it is usually impracticable on account of adjoining tracks, or wasteful on account of the number of "dead" stalls which must be left for ingress and egress; locomotives must generally go upon the turn-table on entering and leaving the roundhouse, and the turn-table must, as a rule, be turned with the engine upon it in both cases; that is, always turned twice for each engine each trip. In snow countries, it is best to completely cover the engine house and turn-table, which, in the circular construction, either involves an enormous building or a great sacrifice of room, owing to the rapid divergence of the interior tracks. A good example of this is the uneconomical Truckee roundhouse—a complete circle, with only 22 stalls.

"These considerations suggest an engine house built in rectangular form with one or more transfer-tables, running between the two sections of the building, or, if two sections are not desirable, in front of a single section, for the purpose of transferring the engines from the stalls to the outging tracks and from the turn-table and incoming tracks into the engine house. An outline sketch, giving a proposed rectangular engine house, is accordingly submitted; also a diagram giving a proposed typical track approach (which, of course, would have to be modified to suit local circumstances), and showing graphically the relative areas of the two kinds of engine houses for the same number of useful stalls.

"It is proposed in this arrangement, as a rule, to cross the turn-table but once with the engine, usually as it comes into the engine house. The engine would leave the main track and take the incoming track to the engine house, take coal, water,

pass over the ash-pit, and if it had to be turned in order to head out right, over the turn-table on to the transfer-table, otherwise straight to the transfer-table without passing over the turn-table, and into the engine house. On coming out the engine would go upon the transfer table and take the outgoing track.

"As to the time required by the use of transfer-tables, we must divest ourselves of prejudice and forget the old-fashioned chains, cables and other clumsy appliances with which transfer-tables have been and still are, to some extent, operated, and remember that with the present high development of compressed air, machinery and electric motors, very heavy weights, in fact, whole passenger trains, are handled economically and expeditiously with properly designed motors.

"These considerations perhaps render it unnecessary to say much about motive power for the transfer-table, but taking one of our heavy engines (Class F. B., weight, 146 tons), and equipping the transfer-table with two twenty-five horse-power street car motors, coupled so as to be thrown into parallel or series, a velocity of five feet per second (3 4-10 miles per hour) would be attained in a run of 20 feet, requiring eight seconds for the run, on the supposition that the torque of the motor is uniform for all speeds. Efficient brakes could stop it in the same distance, so that a 40-foot distance can be accomplished in 16 seconds. At the acceleration of five feet per second, or three and four tenths miles per hour, it would take about 16 seconds to take the locomotive from opposite the end stall nearest the turn-table to the adjoining exit track. If a sufficient distance is to be run, the speed will go on increasing, though not at the same rate, but making no allowance for this increase in speed, the time required to run from the center of the engine house, as shown in sketch, to the center of the exit track, would be 60 seconds, or one minute, and from the extreme end of the house one minute and 46 seconds. The engine would then be in position to go out into service without crossing the turn-table unless headed wrong. Of course better time could be made with motors of greater power. The writer happened recently to time several engines upon a turn-table operated by a compressed air motor at a very busy roundhouse belonging to the Southern Pacific Company, near San Francisco, and found that none of the engines were turned in less than one and one half minutes from the time they were upon the table to the time the table was in position for the engine to go off.

"It would seem, therefore, that as a question of time in handling the engines for exit from the house, that the average time required in the rectangular engine house would not necessarily be more than the average time required in the roundhouse, unless the engine has to be turned in going out.

"If it is still contended that the use of transfer-tables will require more time (although no time need be spent balancing the engine upon it, as upon a turn-table) the answer to this would seem to be to start the engine out a fraction of a minute earlier.

"As to the transfer-table as a piece of mechanism: This is a very simple piece of apparatus and need not be expensive, as it should consist of three heavy trucks, connected together by I

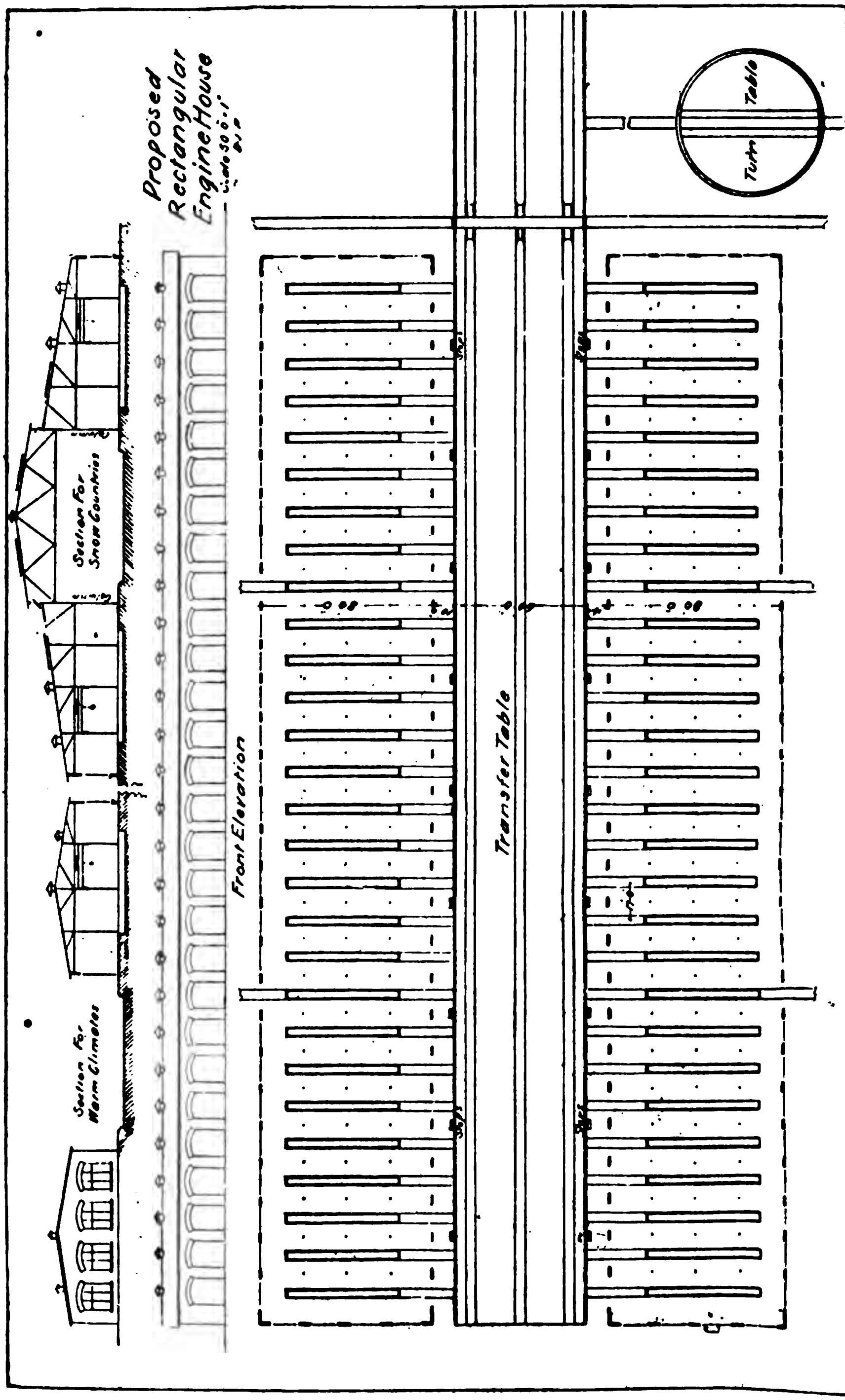


Fig. 36.—Plan of Rectangular Engine House Proposed by Mr. John D. Isaacs, Meeting of Pacific Railway Club, October, 1900.

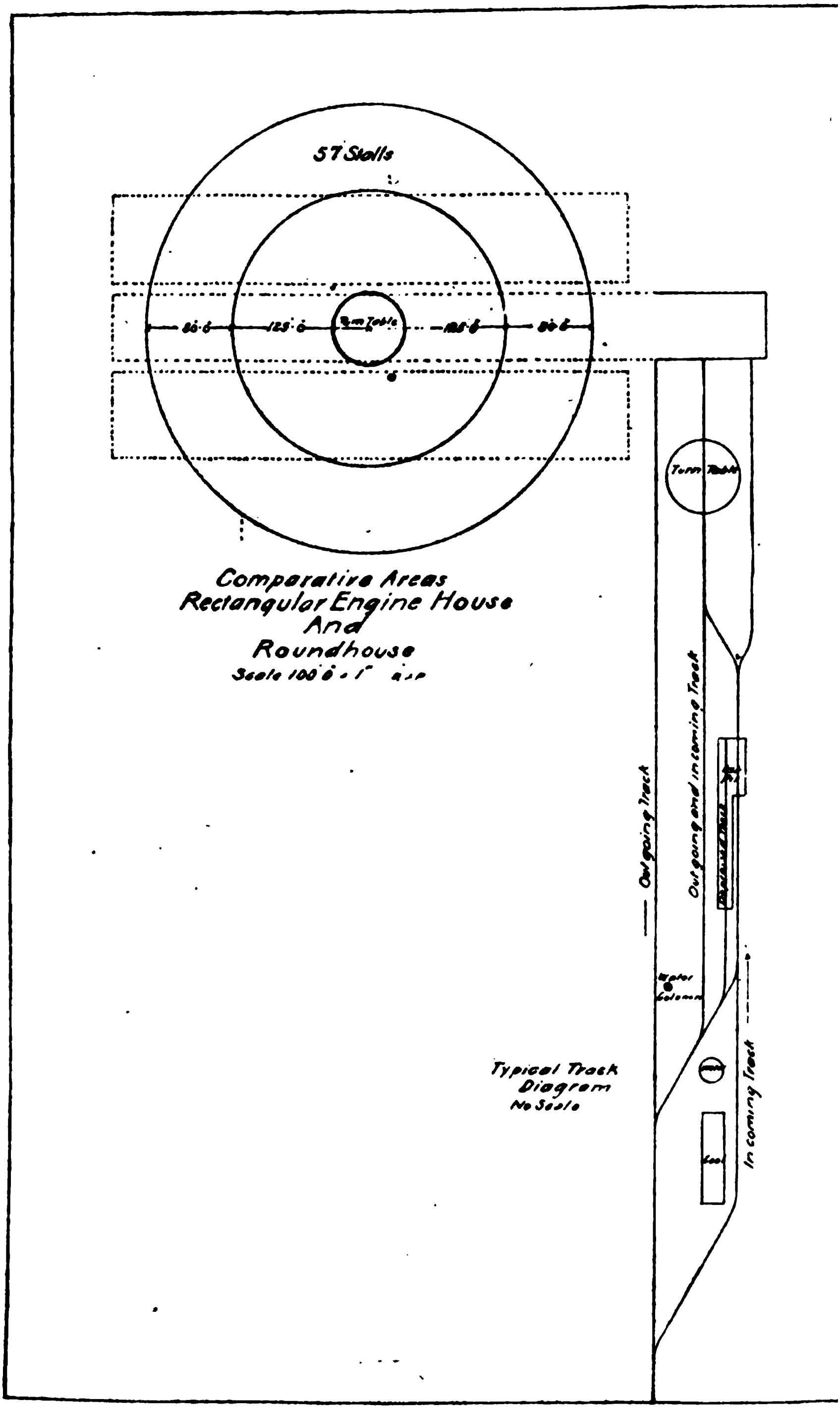


Fig. 87.—Diagram of Comparative Areas of Rectangular Engine House and of a Roundhouse, as Presented by Mr. John D. Isaacs, Meeting of Pacific Railway Club, October, 1900.

beams, on which the rails may be laid direct to save depth of pit.

"The rectangular design is not intended to apply to small engine houses; it is primarily for larger accommodation, or for locations in which a large increase in business is anticipated.

"As to facilities for connecting an engine house with adjacent buildings, such as blacksmith shop, machine shop, etc., the rectangular building enables direct tracks to be run as desired. A good example of the disadvantage of circular buildings in this respect is the case of the S. P. roundhouse at Bakersfield, where, without entirely destroying the appearance and utility of much of the building, it was found to be impracticable to get more than three tracks from the rear of the roundhouse into the adjoining machine shop, and to do even this it was necessary to build one of the doors a foot out of center, curve a pit and introduce 27-degree curves, reversed. Of course, the answer to this is that the machine shop should be put further away from the engine house, but here again we get into a serious sacrifice of valuable ground space.

"As to the land occupied by the two classes of building: A circular engine house with, say 57 stalls, would occupy a net area of three and two-hundredths acres. Assuming that three of these stalls would be kept unoccupied for access in so large a building. A rectangular engine house with 54 stalls would occupy a net area of two and six-tenths acres, or about 16 per cent. more net area for the roundhouse than for the rectangular building. In point of fact, the circular building may be practically considered as occupying a square of ground whose sides are equal to its diameter, as far as the useful purposes of the ground is concerned. To offset this, there should be added, say 110 feet extra length of transfer pit outside the rectangular building for convenience of access to the various tracks. These compare as follows:

Rectangular form of building, ...	2.74 acres
Circular form of building	3.86 acres

or about 40 per cent. more ground occupied by the circular form of construction than the rectangular. All these calculations are based upon dimensions given upon the plan, which it may be desirable to change one way or the other, in which event, of course, a corresponding change takes place in the comparison.

"As to the facility in handling work in the shop, it would seem that the rectangular building enables one or more light overhead traveling cranes to be run over as many stalls as may be desirable, by which means lighter portions of the engine could be removed and replaced. It may occasionally be desirable, at least temporarily, to utilize portions of the rectangular house for repairs, painting, etc., which more particularly belong to the machine shop; in such cases there is no objection, save possibly from an architectural point of view, to making the spacing, center of center, of some of the doors different from others. From a maintenance point of view, the absence of frogs leading from the turn-table is a considerable advantage, and the cost alone of the frogs done away with in a 54-stall building, would

pay for the transfer-tables with motors and controller complete.

"For the sake of tidiness and of pleasing effect, the writer would go to the extravagance of covering the entire space occupied by the rectangular building or buildings, including the building, the transfer pit and the space between it and the building with a cement floor, similar to an ordinary cement sidewalk.

"Without pretending that the new scheme is entirely worked out in detail, or that the arrangement of the building and tracks, as per enclosed drawing, is by any means the best possible and cannot be improved upon, the idea of a rectangular engine house would seem to have so many advantages as to warrant the conclusion usually reached by the late A. J. Stevens, General Master Mechanic of the Southern Pacific Company, after such discussions, 'Let's build one of the d—d things and see what is looks like.'"

JOHN D. ISAACS,
Asst. Engineer, M. of W., S. P. Co., San Francisco.

V.—Best Method of Filling Ice Houses and Conveying Ice to Refrigerator Cars.

REPORT OF COMMITTEE.

Your committee have been unable to go into this matter as deeply as the importance of the subject seems to merit. We find that the varied conditions met with in different localities seem to require different methods as to detail. For filling ice houses of, say 1,000 tons' capacity, or less, hand labor with the use of a horse as the lifting power would be the most economical, but for a larger house it seems that a power plant of some kind would be most economical, especially so at points where the season for putting up ice is at times limited to a few days, in which case the harvesting must be done as quickly as possible. As to the kind of power best suited for the work we are unable to offer any suggestion, but it appears that the endless chain conveyor in a general way would be found to be the best to which to apply any power. This method seems to be the best in cases where the pond or other source of supply is near by or where the ice may be brought to the plant in cars. In the matter of conveying ice from an ice house to refrigerator cars, your committee would suggest as most preferable a platform of suitable height to admit of ice being carried to one or more cars at the same time by means of an endless chain or other device by which the ice could be dumped into the cars through the usual openings in the roof. This elevated platform seems to be a practical plan, as in cases where it is desirable to re-ice an entire train of cars, one half of them could be placed on each of two tracks and the work of re-icing be completed quickly without any unnecessary delay to the train. This platform, however, would have to be fitted with light wing platforms hinged to the side of the same at proper intervals, that could be lowered down to rest on roofs of cars. This plan involves another one by which the ice is to be taken from the house and delivered to the conveyor on this elevated platform. We find there are several devices now in use for taking the ice from the house, one of which is an automatic air pressure lowering device for use on outside of house from which the plate ice can be delivered to the conveyor by gravity. This appears to be the best for that purpose, but it may be found necessary to use a gig or other device at times for hoisting the ice on inside of the house for delivery to the lowering device.

At points where crushed ice is used, the conveyor on the elevated platform would be dispensed with and the platform should then have a smooth floor over which a wheeled hopper-bottomed cart or buggy could be easily handled. This cart or buggy could be filled with crushed ice by gravity direct from the crusher and conveyed to the elevated platform.

J. T. Carpenter,
J. P. Canty,
F. L. Burrell,
C. M. Large,
A. McNab,
Committee.

DISCUSSION.

Mr. E. D. B. Brown.—Several years ago I had occasion to look into this matter for our company and I examined several large plants. Most of them were operated by the large packing companies and were constructed by them. I went particularly into the operation of these different plants. Of course, in the icing of cars there are two classes of ice used: crushed ice and cake ice. There are a number of houses, like the one at Altoona, which have five compartments, practically square, about 35 feet, and made practically air tight. They are filled with ice and the ice is covered on the top with sawdust or hay, as the case may be. Then they start and use out of these compartments with an automatic lift lifting to the top of the house where in the roof trusses they have a gravity slide to the crusher over the center compartment, and pile it back to the crusher room when crushed ready for distribution. The general method of handling crushed ice is by the buggy system. Three quarters of an hour before a train is due the man in charge of the ice house receives advice of the number of cars to be re-iced and also of practically the amount of salt needed. He would in the meantime have his men fill the buggies in the crusher room and hold them there until the train was in sight and then run them out on the platform.

I know of no house with an automatic conveyor for conveying it along the platform. In the summer the excessive heat would reduce the quantity of ice to such an extent in a conveyor that it would not be practicable. They usually have a track directly in front or in the rear of the house from which the house is filled, a hoist being used, operated by steam or electricity. In almost all houses, except the one at Altoona, the ice was slid along from room to room and then hoisted to the crusher room, until each room was empty. For salting the cars, on almost all the platforms they have sub-platforms, which are below the high platform, and on this they have boxes with salt and throw the salt in as

the ice is being placed in the cars. For handling the broken or crushed ice from platform to cars they have a chute from the high platform, which they throw into the refrigerator portion of the car and move it along from car to car on a strip about 4 x 6 inches, secured to the edge of the platform. I have spoken to several of the men interested in these large houses with regard to conveying ice by an endless chain or conveyers, and they thought it was practically impossible; that is, impracticable, at least, except where they do the initial icing, but where they do the re-icing of cars I think you will find that they use the buggy device entirely.

In regard to the cost, if I remember rightly, the cost of re-icing a house was anywhere from $1 to $1.30 per ton in the building. Then figuring depreciation of plant, interest on original cost of the plant, and the wages of the men operating the house, it costs about $2.15 to $2.45 per ton to get ice as crushed ice into the refrigerator cars. Of course, this is determined greatly by the wages at different points. These figures were made several years ago and may be raised slightly at the present date on account of the increased cost of labor.

Mr. Penwell.—This subject was brought up a year ago and at the time there did not seem to be much demand for the subject, because few of the railway superintendents of bridges and buildings seemed to be in need of it. I was particularly interested in it, however, because I had charge of re-icing cars on our road. I have visited the largest ice houses in the country, including Chicago, and in the matter of the construction of the houses I found ours as good as any. However, I was not quite satisfied with our plant because other people were handling ice more economically than we. We have a house of about 8,000 tons' capacity, and we convey our ice from the cars to this house by means of platforms and a sprocket chain running over a sprocket wheel near the top of the house. The main ice house is in three compartments, with the crusher house in the front,

and we can move this crusher house from one house to another. In taking out ice we use the same method as in filling the house, reversing our machinery. For re-icing cars where we want to use crushed ice, we load it into buggies similar to those described by Mr. Brown, and the method of re-icing cars is identically the same as he describes. If we are loading full carloads of cake ice, we let the ice down on a lower platform, which is 380 feet long, and then load it into cars by hand. I have the plans of our house with me and if any of the members wish to see them they can do so, and if it is desired to embody them in the report I will turn them in.

Mr. Shane.—This is a subject that I am very much interested in, since we are, on our line of road, icing from 250 to 400 cars daily, and we find that our crude methods are very expensive. We have men working twenty-four hours a day, ten during the day and ten at night. We can utilize this force to some advantage during the day, but not at night. In order to overcome that loss we have the night men do most of the crushing, which we have done by hand, and which, of course, is very expensive. We are going to put up a new plant and want to get the most modern method of icing cars. I can see no reason why we could not have an arrangement by which we could ice a train of cars in the same length of time in which we could ice one car, and that is our object. I have been corresponding with all the ice manufacturers that I could reach, but I have not been able to come to a satisfactory conclusion on this subject. We are aware of the fact that we cannot crush the ice rapidly enough to ice all the cars at one time; the ice must be prepared. We break the ice up by hand and have as much as 10 or 15 carts filled by the time the train arrives. A second refilling of these carts is necessary and this causes delay, and we find our meat trains are delayed at the icing station nearly an hour when they should not stop there more than 10 or 15 minutes. I have in mind a method which, I believe, is practical, and after

I have given the matter more attention and thorough investigation I think that I will be able to suggest it, and that is to have a very large and modern crusher and modern conveyor and a platform of a train length with pockets, which can be filled with crushed ice by means of the conveyer, and since our people are advised beforehand of the number of cars, they could have that number of pockets filled, so that all that would be needed would be to stop the train at the platform and re-ice all the cars at once. In order to do this men could be called from the shops for that short time and a very small force could have the ice crushed and the pockets filled. This is simply an idea of my own and it may not, after I have gone into it, be quite practical, but it does seem that we should be able to prepare plans by which time could be saved.

Mr. A. S. Markley.—I will ask Mr. Shane how he would arrange his pockets. He will have various lengths of cars and will want to dump the ice from the pockets into the cars.

Mr. Brown.—I think that Mr. Shane will find that the large companies who do most of the re-icing, figure that the men in handling the ice in the house to bring it to the crusher do not spend more than one third of the time in this part of the work; the rest of the time they spend in filling and handling the buggies and preparing the cars for receiving the ice. Moreover, I hardly think it would be advisable to have a large amount of crushed ice on hand.

Mr. Penwell.—In the Armour ice plant they crush enough for about two train loads, but their crusher house is made thoroughly tight and the ice will keep for 24 hours. They fill all the carts they think they will need and also have a reserve of a few carts. They have no difficulty in crushing this ahead of time. In the ordinary crushing rooms, that are not made air tight, you can only figure on filling the carts. I see the importance of building as nearly air tight a crusher room as possible. We have made a mistake in not doing so ourselves.

Mr. Brown.—In the houses that I have in mind the crusher rooms are made air tight. Even then, most of them did not wish to hold any more crushed ice than they could help over their immediate needs.

[Note.—Cooling cars by carrying ammonia cylinders is suggested.—Ed.]

VI.—Best Method of Filling Track Water Tanks Automatically.

REPORT OF COMMITTEE.

To the Officers and Members of the Association of Superintendents of Bridges and Buildings:

Gentlemen: Your committee on subject No. 6, "Best Design for Automatic Filling of Track Tanks," has to report that, owing to failure to acquire the necessary information relative to the details, etc., concerning the subject, a proper report cannot be presented as yet, but that the question may be brought before the Convention for preliminary discussion if desired, we have to suggest that the track tanks be handled as follows:

The pumping plant to be either steam or gasoline propelled, preferably the former on account of the necessity for steam heating in winter time and where ordinarily a sufficient roadside tank capacity would be maintained, so as to require the use of only one pumper in the 24 hours, this can be reduced as it is considered desirable to keep one pumper on at night and one during the day, so as to have continuously a proper supervision over the plant.

From the roadside tank, which also may be called the storage tank, the water should pass by gravity to the feed pipe and the track tank, the number of valves leading into this latter tank being governed by the length of the tank and spaced for good practice about 300 feet apart, so as to keep the flow in the tank fairly regular and to do away with overflowing at any one point.

At each point of valve connection a side branch from the main feed pipe should be carried in an enclosed box with a ball float acting with the level of water in the track tank, opening and closing the same as the water rises or falls.

The use of a valve like the Gulland valve is recommended to govern the flow of water into the track tank.

By the next meeting your committee will have full detailed plans prepared, showing the above arrangement.

E. B. Ashby,
F. E. Schall,
Committee.

DISCUSSION.

Mr. R. H. Reid.—We have track tanks on the main line of the Lake Shore and we have found it more satisfactory to fill the tanks with pipes in the ordinary way. We have a man continually at each tank, who looks after shutting off the water and turning it on, and it is also necessary to have him there continually to keep the tanks clear. Pretty

nearly everything falls into them and it is necessary to clean them out and keep cleaning them out. By allowing the water to run at full head the tank will fill more quickly, while, with an automatic device, when the water gets up near the top it runs slower and slower, and if you have many trains you will not have a full tank for all of them.

Mr. Steffens.—I do not agree with Mr. Reid on that subject. We have at one of the busiest points on the system an arrangement such as recommended, and the installation of the automatic valve has given the most uniform satisfaction. The tanks fill in from two to three and a half minutes, according to the amount of water scooped out; an average of three minutes might be quoted. There has never been a time after the passage of a train when the next one failed to obtain water.

The original installation at this point was equipped late in 1903 with one Gulland valve, made by the Best Manufacturing Company. Its installation was for the purpose of test. The valve in its simplest form in shown in the illustration. (See Fig. 38.) The construction and operation of same in brief are as follows:

In the bottom of the main portion of the valve is an enclosed chamber, through which the small vent tube passes, as will be noted. Above this chamber is a cylindrical, hollow projection, containing serrated openings, one of which is visible in the cut. Over this slides a cylindrical valve, which, in the illustration, is shown as partially raised. Water in passing from the inlet to the outlet of the valve must pass through the serrated openings referred to. Near the inlet opening, and cast into the body of the valve, is the small vertical tube shown. At the top of this tube is a small valve held in normal position against the upper end of a two-way seat. With this small valve in the position indicated, water pressure from the inlet opening is permitted upon the top of the sliding cylindrical valve, holding it closed over the serrated openings. If the small valve, above referred to, is pressed down so as to close the

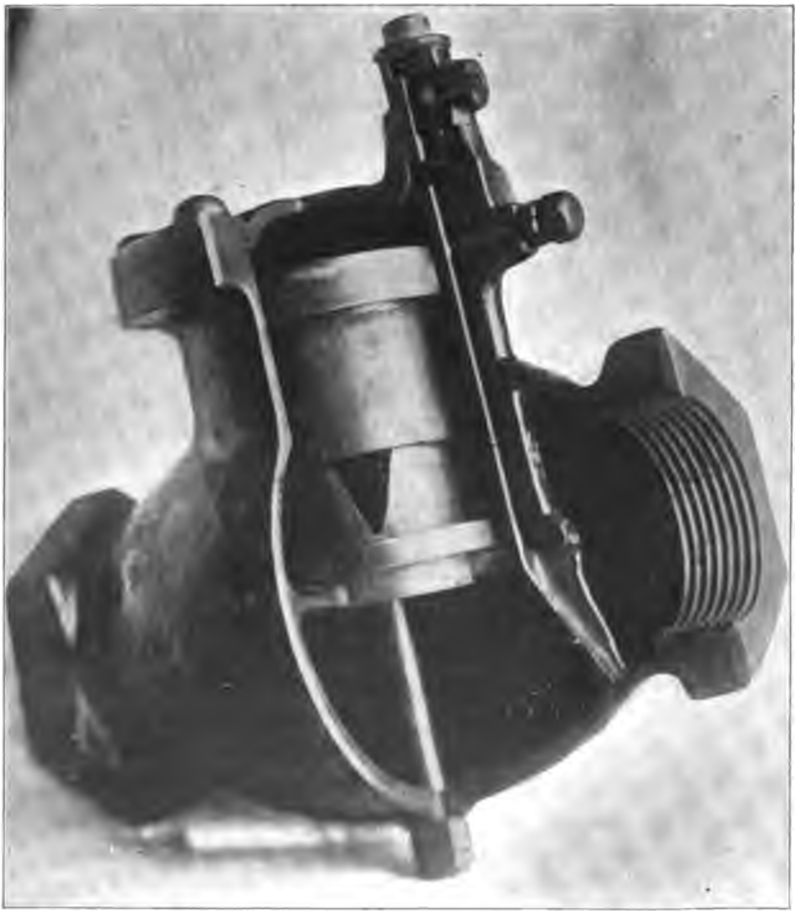


FIG. 88.—Sectional View of Gulland Automatic Valve.

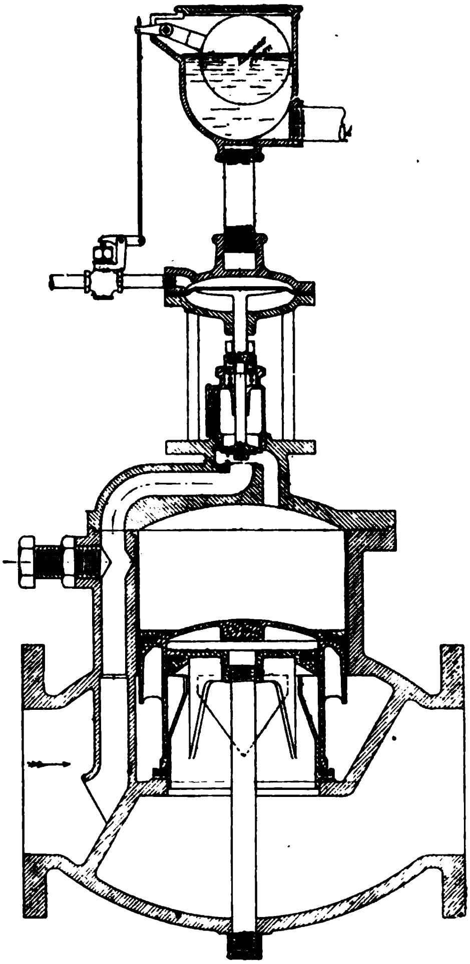


FIG. 38 a.—Sectional View of Gulland Automatic Valve Equipped with Float Valve.

lower opening of the small tube, the chamber above the sliding valve is vented to the atmosphere, or to the supply pipe, and the pressure of supply main acts upon the lower surface of the projecting rim on the sliding valve, thus raising it. It should here be stated that it is impossible for the water pressure to act on the upper inside surface of this sliding valve, as the serrated portion is made solid at the top. When pressure on the trigger valve at the top of main valve is reduced and the pressure allowed upon the top of the sliding valve, the latter closes gradually, thus largely preventing hammer in the supply main. Supervisor Mills (member of this Association) succeeded in applying to this valve a float attachment, which is shown in the illustration (see Fig. 38), with the object of eliminating attendance. The experiment was entirely successful. The length of the pans at this point being about 1,400 feet, the other two valves were similarly equipped (the valves are about 500 feet apart). The float valves are placed outside of the track where the pan is located and in the lead from the main feed pipe line to the inlet, which is a six-inch pipe. Lowering the water level in the tank operates the float which governs the valve. This is situated about 60 feet from the inlet and connected with a one and a half inch pipe, so as to remove local disturbance of the water level in the pans. The operation of these valves follows immediately when the water level is lowered by scooping, far excelling their operation by hand. In the latter case the valve at one end of the pan could not be shut off in time so as to prevent overflow. Hence the economy of the system is not only in attendance, but in amount of water no longer wasted. Since the original installation a second installation has been made at another busy point on the system, and is also satisfactory. The exhaust from the valves is led back into the discharge pipe, thus further preventing waste of water. It is hardly necessary to add that the valve boxes are kept locked so that no one, except those properly authorized, have access to them.

VII.—Steam Hammers vs. Drop Hammers for Pile Drivers.

MAJORITY REPORT.

To the Association of Railway Superintendents of Bridges and Buildings:

The investigations of your committee show so few steam hammers in use for road work compared with drop hammers that it has been difficult to obtain reliable information.

The superiority of the steam hammer for some classes of work, such as foundation work under buildings, piers, etc., is apparent; while for road work, those who are using steam hammers would not exchange them for drop hammers under any circumstances.

In the city of Chicago where, perhaps, more piles are driven for foundation work than anywhere else in the United States, steam hammers are used almost exclusively, and it would be hard to convince any one in the business that any other hammer could be used advantageously.

The Illinois Central have steam hammers in use for foundation work and also use them in driving false work from the ground. They are said to have given most excellent service.

The C. & E. I., the Santa Fe, and the Fort Worth & Denver railways all use steam hammers most successfully in road work.

All who use steam hammers, so far as your committee knows, are loud in their praises of this type of hammer. Those who have not used steam hammers seem to think a drop hammer is good enough for them.

Your committee believes the steam hammer is the best type of hammer for all kinds of pile driving, and when used with a bonnet makes pile driving a comparatively easy job. Piles can be driven without injury to the pile in almost any kind of earth with a steam hammer, where it would be rent from head to point by a drop hammer. The pile is held much more firmly under the steam hammer, and is guided home in much better fashion than can be accomplished with the drop hammer; besides there is not the injurious strain upon car and machinery that is felt from the drop hammer.

The cost of maintenance is much less for the steam than for the drop hammer, and the cost of driving piles is also much less. The first cost of the steam hammer is, of course, much greater, but it is a good investment notwithstanding.

The size of the steam hammers may vary for different kinds of work—the No. 1 for foundation work and the No. 2 for road work, though some prefer the No. 1 for all classes of work.

O. J. Travis, *Chairman.*
N. H. LaFountain.
F. J. Leavitt.
G. O. Lilly.
H. Rettinghouse.

MINORITY REPORT.

Replying to your circular letter of Aug. 24th, relative to report of committee on Subject No. 7, "Steam Hammers *vs.* Drop Hammers for Pile Drivers," I do not agree with the balance of the committee in the statement that the steam hammer is the best type of a hammer for all kinds of pile driving, as I think for very hard driving, such as hard clay and hard pan, and in some cases for very soft driving, that the heavy drop hammer is the best, as it has enough energy in its blow to break the hold of the pile in the earth and force it down, where many times a steam hammer will not do this. I have seen a steam hammer bang away on the tops of piles until they were completely worn off and got so hot that they even took fire, but still would not go down. I think, also, that a drop hammer is more convenient to handle than a steam hammer, in a road driver, as a steam hammer is so very heavy that the driver needs lots of counter weight to balance it when swung. Also, they are so long that very long leaders must be used in order to get piles under them, and with a heavy hammer at the top of the long leaders the machine is very likely to tip over on the track with much elevation or a track which is very much out of surface, as the tracks frequently are where work is being done. If I could only have one hammer for general railroad pile driving I would prefer a drop hammer to a steam hammer, as I think the work in general can be done cheaper, everything considered, with a drop hammer than with a steam hammer.

I understand, of course, that a steam hammer is very desirable in some kinds of work, but for a single hammer I would prefer a drop hammer.

In regard to using a bonnet with a steam hammer, this same piece of head gear can be used fully as well with a drop hammer, and will take up proportionately less of the energy of the blow of a drop hammer than of a steam hammer.

R. H. Reid.

The following written communication was received from Mr. A. S. Markley:

"During the past year the Chicago & Eastern Illinois Railroad Company bought a new pile driver from the Industrial Works, Bay City, Mich., with steam hammer. The hammer and frame complete weighs 5,170 pounds. The hammer alone weighs 2,840 pounds; drop of hammer, 28 inches.

In a recent test made with this hammer it developed the following:

66 blows for 1′ penetration with steam hammer, time 1 minute.
83 " " 1′ " " " " " 1½ "

After making the above test the drop hammer weighing 2,900 pounds was placed in the leads with a drop of 32 feet with the following results:

12 blows	1′	penetration	with	drop	hammer,	time	2	minutes.
10 "	1′	"	"	"	"	"	2	"
10 "	1′	"	"	"	"	"	3½	"
12 "	1′	"	"	"	"	"	2½	"

We then removed the drop hammer and replaced the steam hammer, with result given below:

203 blows	1′	penetration	with	steam	hammer,	time	3	minutes.
341 "	9′	"	"	"	"	"	5	"

These tests were all made on the same pile and at the same time just as quickly as the change in the hammers could be made.

With our experience in the past nine months with steam hammers there are several reasons why they are much better than the drop hammer. The effect is equal if not better than the drop hammer and requires no toggling; when the pile is once placed in the leads the hammer resting on it holds it in line, while with the drop hammer a great deal of toggling is necessary.

With the hammer we have a pile can be driven seven feet below the base of rail. With this arrangement, by using a little care, piles can be driven to their proper depth without being sawed off to put on the cap for temporary work. This we have done in a number of cases with good results and considerable time saved. In several cases where the piles after being driven the tops of which were of uneven surface, after the cap had been placed on them, the steam hammer was set on the cap, and pile driven so that the cap had a uniform bearing on all of them. With the steam hammer driving the top of piles below the rail, which cannot be done with any certainty with the drop hammer, there is from two to three feet of pile saved on every pile driven, which in the course of a year means considerable saving, not only in the length of piles but in the hammer lines, piles, rings, and time.

In the test just referred to it required a great many more blows with the steam hammer to drive the pile one foot than with the drop hammer, with the latter falling the full length of the leads, 27 feet. The piles were driven just as firm and penetration just as deep with the steam hammer as it could be done with the drop hammer. I believe everything is favorable to the former, with the additional advantage that the steam hammer does not damage the pile on the end and does not require it to be banded, which saves considerable money in this direction. It makes no difference where the head of the pile is in the leads with the steam hammer. It is just as effective one place as another. The longer the piles in the leads the less the drop of the hammer and less effect the hammer has on the pile. With our experience with the steam hammer we can drive four piles with it to where we can drive two with the drop hammer."

DISCUSSION.

Mr. Reid.—I was against all the rest of the committee in their conclusion, they favoring the steam hammer for general use. I prefer the drop hammer for a track driver for general work. For some purposes I admit that the steam hammer is the more satisfactory, but for all-round use I consider the drop hammer the better, and you can get a pile down with a drop hammer in almost every case where you can with a steam hammer. They are lighter and shorter, you do not have to use such long leaders for them, and do not require as heavy a car. The steam hammers are usually from 10 to 12 feet long and when you get them in the top of leaders and have three or four inches elevation of track, or even if the track is one and one half inches out of level, the tendency is for the driver to tip over. There are some places where neither the drop hammer nor the steam hammer will work. At one place we were driving piles from 55 to 60 feet long, down through hard pan to bed rock. We tried a 3,200-pound drop hammer and could not get the piles down fast enough, so, after more or less discussion, we tried the steam hammer. We pounded those piles until they took fire, but they did not go down. The steam hammer would set on those piles for two or three hours and would not move them. Finally we put in a 4,500-pound drop hammer and put the piles down without any further trouble.* We got them down in short order with the drop hammer, as there was force enough in the blow to break the hold in the hard pan. A steam hammer strikes a short blow and many of them, but they do not have sufficient force behind them. Of course, I would not advocate a light drop hammer. It simply batters the piles without doing any good, while a good heavy drop hammer will do the work. There are cases where a steam hammer may be better. You can work a steam hammer with a water jet, but you can do the same thing with a drop hammer.

* It is doubtful if the piles thus driven ever reached bed rock. It would have been of interest to have pulled one of them for examination. Many of them undoubtedly failed long before point of absolute refusal was reached.—Ed.

Mr. Carpenter.—I have never had any experience with a steam hammer on the road. I was somewhat interested in Missouri River improvement work some years ago where they had steam hammers. They did very good work. On the other hand there was one place where I drove three 30-foot piles on top of each other, 14 feet from the track center, on inside of a five-degree curve, and with the wheel on one side of my car four inches off the high rail, and I do not think a steam hammer would have ever done the work. It would have been too heavy. I do not think that a road driver with a steam hammer would be as practical a tool for all purposes as one with a drop hammer, as with a drop hammer the blow can be regulated to suit the conditions. Some piles will stand a great deal of hammering and some will not, and I can get better results with a drop hammer than I could with a steam hammer. If I had to take a steam hammer out of the leaders every time I wanted to use it for other purposes, it would be a costly and difficult operation. I am decidedly in favor of the drop hammer for the average road work.

Mr. Henson.—I have had considerable experience with pile drivers. I used both steam and drop hammers on water driver on incline work on Mississippi River but did not get as good results with steam hammer as I did with drop hammer. Even in quicksand the drop hammer gave us the best results. I think the drop hammer is in every respect the best for all purposes.

Mr. R. H. Reid.—I can give Mr. Carpenter a pointer. Set your tackles up and pull the piles down until you can get the hammer over them. I have driven 60-foot piles that way. Speaking of using a drop hammer for light blows, I have driven two-inch pine sheathing with a 3,500-pound hammer and not split them, simply by using a short blow, and it would strike a little quicker than a steam hammer. If you want a heavy blow, you can strike a heavy blow and break through the surface.

Mr. Carpenter.—I must say that Mr. Reid struck some

softer ground than I ever saw, as I have never seen a place where you could pull a pile down. In this case I had some six feet of rip rap and 50 feet or more of quicksand to go through.

Mr. Steffens.—In driving long piles we first drive a short pile to a reasonable depth; then pull it and in the hole thus made insert the long pile, which is then at a normal height in the leads. This method is more effective in some soils than attempting to pull pile down in leads. The latter method is of great use, however, in soft mud foundation. The water jet is also of value in soft mud or sand. In driving piles in a sort of quicksand this summer inside of a cofferdam, we found that a half-inch nozzle gave best results.

President.—In other words, you manufacture a hole and pull the pile down into it.

It seems strange that so many contractors use steam hammers. If a thing is not satisfactory, they generally find it out. They will always spend money to save money.

Mr. S. D. Bailey.—Will say that in view of my experience in the matter, I would prefer a drop hammer for track driver for all kinds of work. The steam hammer will drive more piles in soft ground, but when hard pan or stiff clay is met the drop hammer will do more work. Since our meeting in Chicago, we have done some driving where steam and drop hammers were both used side by side. Where the ground was very hard the drop hammer did more work.

Mr. Aldrich.—I should like to know what Mr. Reid means by using a 4,500-pound hammer. I had a 2,500-pound drop hammer and drove some piles recently, and when I came to investigate I found quite a lot that were not down in the ground over six feet and the lower ends were ground right up into a pulp. I would like to ask Mr. Reid what kind of piles he uses with a 4,500-pound hammer.

Mr. R. H. Reid.—We had pretty nearly everything in the way of piles—Norway, beech, hickory, white oak, red

oak, sycamore, etc. When we could not get a softwood pile we used white oak. I used 1,000 piles in that foundation and drove about 3,000 altogether. Of course we had to handle the Norway piles a little more carefully than the others. Still, after getting them down a little, we struck them a 40-foot blow with a 4,500-pound hammer. We did not break any white oak or hickory piles. We had to band all of them.

Mr. Aldrich.—In the Hudson River I have driven 60-foot piles with a 30-foot driver and we always banded our piles, and yet we have knocked piles all to pieces with a 1,700-pound hammer in hard driving. I have broken a white oak pile with a 1,700-pound hammer. A light blow with a heavy hammer I think preferable, however.

Mr. Harwig.—I would like to ask if, in driving these piles, the points of the piles were shod with steel or some other metal point in order to penetrate the hard pan or whether they were merely pointed and driven barefooted?

Mr. Reid.—We used no shoes on the piles. We pointed them about six inches square.

Mr. Alexander.—I have never used a steam hammer for pile driving, but I have been with a crew and watched them using a track driver with steam hammer and I was not very well impressed with the work it was doing. I have used a drop hammer on track driver and prefer a hammer 2,400 to 3,000 pounds weight. A pile cap or cast follower may be used on top of pile to hold pile straight in leads, same as with steam hammer. It is also very satisfactory to use cast pile points where ground is hard and stony as the lower end of piles will stand to drive much better than without it.

Mr. Lichty.—I should like to ask Mr. Aldrich what he uses on the head of the pile, a pile cap or a ring?

Mr. Aldrich.—I use a ring; fit the head and put the ring on.

Mr. Lichty.—I find that we split a less number of piles if we use a pile cap than if we use a ring. It is very seldom that we spoil a pile with a pile cap.

Mr. Aldrich.—It is very seldom that we break piles, but in the particular case where we struck hard pan we ground the piles all to a pulp.

Mr. Reid.—In regard to Mr. Lichty's suggestion as to using a pile cap. It can be used with a drop hammer as well as with a steam hammer. At the same time I doubt it you can drive as many piles in ordinary work in using a cap as you can without the cap. You must fit your pile to the cap and after you get the pile part way down you cannot tell which way that pile is crowding. When you take the cap off the pile you may be six feet out of line. We have not used a pile cap in four years. We use just a band and hold the pile in the leads, and get the piles in better shape by drawing them to place while we are driving them. There is no question, however, but that the cap will protect the pile.

Mr. Henson.—I agree with Mr. Reid in regard to the cap. I think them a nuisance. I lead piles with hand sticks and when the pile commences to crowd I stay and correct it; so that when pile is driven I have it just about where I want it. As Mr. Reid says, when you drive a pile without leading it there is no telling where it will go when you pull the cap or hood off.

Mr. Steffens.—The steam hammer is remarkably useful in driving sheet piling.

President.—Mr. Reid spoke about driving sheet piling with an ordinary drop hammer.

Mr. Bailey.—In one instance I drove 50-foot piles with a drop hammer in very hard ground and it took perhaps 35 minutes to get them down. Afterwards, when piles of the same length were driven in this same ground with a steam hammer it took about four minutes. I do not pretend to say that under all circumstances the steam hammer is better than the drop hammer, but I believe that ordinarily in driving piles for trestles, foundations or piers, the steam hammer is the better hammer, providing you can get them light enough to handle on the track. Ordinarily we use the drop

hammer, but I prefer the steam hammer. Our hammer is 2,800 pounds weight.

Mr. Killam.—I put down a pile foundation around a pier that had partially capsized. The piles were driven 32 feet into the mud and 20 feet of mud or hard bottom, and were pointed with a shoe and fitted with iron bands on the top. They were spruce piles, exactly straight, banded with iron, five eighths by three inches. To drive one of these piles with a steam hammer, such as is spoken of, with one foot fall, I think would have required 12 months, if the head of pile did not wear out. In preparing specifications I provided for a 2,200-pound hammer to have a fall of 25 feet and to stop driving when penetration should be only one inch at a blow.

The nature of the material penetrated affects the amount of driving necessary. In some cases we pulled the piles and found that they had not penetrated the bottom. As soon as they were shod they went down all right.

Mr. Penwell.—I had a pretty good opportunity last March to make a test between the steam and the drop hammer. I had never used a steam hammer. We happened to have a washout while the Pennsylvania was moving a train over our road trying to get to one of their places of trouble. Our bridge went out and we had our driver on the opposite side. They used their steam hammer on one side and we used our own drop hammer on the other. They could set a pile and drive it straighter than we could, but could not drive it so far. For ordinary work I should prefer the steam hammer, but for putting in permanent work for foundation, I think the drop hammer is better.

Mr. King.—In this discussion about driving piles and liability of piles to shatter under the blow, I have not heard anything about the condition of the piles, and I have found that it makes some difference whether you have green or dry piles.

Mr. R. H. Reid.—A 4,500-pound hammer could drive any pile without shattering it. I believe that where it is

practicable to get in a pile that is water-soaked or green, you would have no difficulty in driving it without shattering it.

Mr. Riney.—I believe the ground has been covered on this question but will say we have had the best of success with a 2,400-pound drop hammer. A heavier hammer without a follower would injure our piling and break many of them, as we have clay and very coarse gravel and rock formation.

Mr. W. H. Finley.—In this question of driving piles the whole thing depends on the nature of the soil through which you are driving, and the specifying of a certain amount of penetration is not a safe guide. I will just recall one experience of pile driving with a drop hammer, where the engineer in charge wired me that the pile was going eight inches at the last blow and when I got there I found that this was correct; but when we tried one of the piles that had been in nearly 48 hours we found great difficulty in driving it down far enough to put on a second cap. That is one kind of a foundation. I recall another where we were driving through a sandy foundation and where we drove probably 800 piles, and we struck each pile about 500 blows to get it down to where we wanted it to go. This was nearly a quicksand and the piles went almost as far the first blow as the last. The contractor protested and said that the piles would be all split to pieces. To satisfy him I had one of these piles withdrawn after considerable trouble, and found it in excellent condition. This was an oak pile, pointed and driven without a shoe. We drove some of the others without a shoe but did not get as good satisfaction as we did after we used a wrought iron shoe. All of these piles were struck on an average of 500 blows per pile. My experience with the steam driver is that it gives better satisfaction than the drop hammer. I believe it is more scientific and does not give as much punishment to the piles. We used a steam hammer for driving piles through blue clay and got better results than with piles which were be-

ing driven near by with a drop hammer. The only point I wish to make is that in all discussions of pile driving you must take into consideration the nature of the soil in which you are working.

Mr. L. J. Anderson.—On the Peninsula Division we have used both the steam and drop hammers and found the steam hammer to be the most satisfactory in sandy ground and in quicksand especially, but in hard or stony ground and for general road driving I prefer the drop hammer. The steam hammer will do well and is better adapted to driving foundations for buildings and docks where water jets cannot be used. We have had a large amount of pile driving in connection with the building of ore docks at Escanaba and found the steam hammer worked to much better advantage in this work. Some years ago we began experimenting with water jet driving and since that time have used that method for all of our foundation work where there is plenty of water, finding it far superior to any other method of getting piles in.

Mr. W. O. Eggleston.—In regard to steam hammers and drop hammers for pile drivers, railroad companies move their drivers over considerable mileage, doing work in many kinds of ground—clay, gravel, quicksand, stone, etc.—and while I never used a driver with a steam hammer, I doubt if a driver with a steam hammer will do general work as well as a driver with a drop hammer. The driver I had charge of for a number of years was a Bay City machine, with a 3,000-pound drop hammer. It was used over the entire Erie system and gave such good satisfaction that the company bought two more similar machines. These drivers are equipped with a bonnet or cap to hold the pile in the leads and this does away with all toggling. If the foreman watches the pile closely he can drive it almost exactly where he wants it to go, doing away with much detention and hard work. I expect a steam hammer will do good work in quicksand, but a good engineer with a drop hammer driver will strike short blows and very rapidly and do equally as

good work as a steam hammer driver will do. In driving in all kinds of ground, I think the drop hammer driver is the best.

Mr. Steffens.—Mr. Anderson's remark brings out a point that was spoken of before. In the case of one deep pier that we have been constructing 300 blows were necessary to drive piles 10 feet into sand. Using a water jet, they practically dropped in. The question of the nature of the material penetrated in driving piles was brought up very forcibly by an experience of this summer in replacing with concrete piers and steel spans a portion of an old trestle across a river marsh, where piles, 45 feet to 60 feet long, were driven to obtain foundation. When first driven, they would not hold up much, but after a month they would not move. The nature of the material penetrated has important bearing on the supporting power of piles.

VIII.—Best Form of Construction for Docks and Wharves.

No report and no discussion. Carried over as a subject for next Convention.

IX.—Best Record Forms for Buildings, Water Tanks, Etc.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings :

Through the courtesy of Mr. R. H. Aishton, assistant general manager of the Chicago & North Western Railway, a supply of record blanks similar to those in use on that line was obtained for distribution among the members of the Association. A complete set of these blanks was forwarded, together with a copy of the following circular to one or more members from each of the various railways represented in the Association, for the purpose of comparison with standards which may have been adopted by them, or, in case they had no standard forms to enable them to make suggestions as to additional records, which, it might occur to them, were desirable. Letter of transmission was as follows:

"The committee on the 'Best Record Forms for Buildings, Water Tanks, Etc.,' submit herewith for your approval or criticism a complete set of blank forms now in use on the Chicago & North Western Railway, and would request that you give this matter your early consideration, and furnish the committee, at as early a date as possible, any information you may have on this subject.

The following are the points in connection with this subject, which the committee have deemed it important to give consideration, and in making your reply it would facilitate matters if you would use corresponding numbers, and if you have any information not called for, let it follow the regular subjects :

First.—Would the blanks submitted meet the requirements of the railway on which you are employed? If not, kindly state what changes would be necessary to make them answer the purpose for which intended. If possible kindly furnish sample blanks similar to those now in use on your road.

Second.—What do you consider would be the most desirable size for forms?

Third.—Do you think it desirable to have the forms printed on thin paper, similar to the sample, so that prints can be taken from them for the use of other officials or would you prefer heavier paper?

Fourth.—Do you favor the loose-leaf record system or would it be preferable to have the blanks bound in book form?

Should it happen that you are not interested in building records, kindly forward this letter, together with the sample blanks, to the official who has charge of such matters. As you

are the only employee of your road to whom this circular has been addressed, the committee will consider your views on the subject as representing the entire system, unless otherwise advised.

Kindly forward your reply to B. J. Sweatt, Division Engineer, C. & N. W. Ry., Boone, Iowa.

Out of a total of eighty-nine members, to whom this circular was forwarded, only twenty-eight replied, and of this number fifteen expressed themselves as entirely satisfied with the C. & N. W. Ry. blanks; the others, either had some suggestion to make or submitted blanks in use on the railway represented by them.

The following is a list of the members who reported as being favorable to the C. & N. W. Ry. standard blanks:

Berry, J. S., St. L. S. Ry., Tyler, Texas.
Berry, William, S. A. & A. P. Ry., Yoakum, Texas.
Burpee, Moses, Bangor & Aroostook R. R., Houlton, Me.
Eggleston, H. H., Anderson, Ind.
Gilchrist, Ed. M., K. & W. & C. B. & K. C. R. R., Centerville, Iowa.
Goodale, L. F., H. & St. J. R. R., St. Louis, Mo.
Hull, K. S., G., C. & S. F. R. R., Beaumont, Texas.
Jonah, Frank G., St. L., B. & M. R. R., Corpus Christi, Texas.
McGonagle, W. A., D., M. & N. R. R., Duluth, Minn.
Montzheimer, Arthur, E. J. & E. R. R., Joliet, Ill.
Pickering, B. F., Boston & Maine R. R., Sanbornville, N. H.
Shane, A., T., St. L. & K. C. Ry., Frankfort, Ind.
Smith, L. D. G., C. & S. F. R. R., Cleburne, Texas.
Thorn, J. O., C. B. & Q. R. R., Beardstown, Ill.
Vandergrift, C. W., C. & O. R. R., Alderson, W. Va.

The following members recommended minor changes from the C. & N. W. Ry. standards:

Mr. E. E. Pratt, Superintendent of Buildings of the N. Y., N. H. & H. R. R., suggests that a place on the record of buildings be provided for two photographic views of all valuable buildings, same to be used in adjusting fire losses; also that the space for heating be made larger, so that the make and number of the heater and the size of grate can be shown; also that a column be added to building record to show the number of lights and size of glass in each window.

Mr. Walter G. Berg, Chief Engineer of the Lehigh Valley Railroad, would prefer a blank limited in width to 8 or 8¼ inches and in length to 13 or 16½ inches to facilitate folding with correspondence; otherwise he approves of the C. & N. W. Ry. standards.

Mr. J. B. Dickson, Engineer of Maintenance of Way, B. & O. R. R., to whom this circular was referred by Mr. J. E. Greiner, has the following suggestions:

First.—The blanks submitted would meet the requirements of this company, with the changes as follows:

Record of water stations should be marked sheet No. 1 and sheet No. 2. Under water tanks columns should be provided to show "kind of support," "when painted," "kind of roofing," "number of hoops on tub," and "kind of tub" (wood or steel). Under stand-pipes provision should be made to show "length of supply pipe" and "date installed." Under pumps should be provided to show "maker's shop number." Under boilers provision should be made to show the "average working pressure." Under gas or gasoline engines should be shown "by whom operated," "the gasoline storage capacity," and "kind of battery used." Under water supply there should be columns to show "city supply pressure," "city supply—make of meter," and "city supply—size of meter." If the original cost of the plant is required it should be given in detail instead of in a lump sum. The lines on both sheets should be numbered to correspond with each other, and space should be provided at left end for binding.

Record of Track and Station Scales.—No suggestions.

Record of Buildings.—Under platforms it should be shown "distance from gauge line of rail to face of platform."

Record of Miscellaneous Property.—No suggestions.

Record of Turn-tables and Cinder Pits.—Under turn-tables it should be shown the "kind and size of center stone." Under cinder pits it should be shown whether elevated or depressed."

Record of Engine Houses.—Under pits it should be shown the "number and size of driver-wheel drop pits" and "number and size of truck-wheel drop pits."

Record of Stock Yards.—No suggestions.

In addition to these changes a column should be left for "remarks" after each class of structure.

Second.—I should recommend the size of about 12 inches by 18 inches over all provided the information can be gotten on that size blank and provide suitable margin on the left end for binding.

Third.—I think it desirable to have the blanks printed on thin bond paper so that prints can be taken from them whenever desired.

Fourth.—I prefer the loose record system, as it facilitates corrections, additions, etc.

Mr. A. E. Doucet of the Quebec & Lake St. John Railway prefers heavier paper; otherwise the blanks meet with his approval.

Mr. E. P. Hawkins of the Mobile & Ohio Railway has the following to say in regard to the C. & N. W. Ry. blanks:

First.—The blanks submitted will meet all requirements on this railway; we have no forms similar to these on our line.

Second.—I consider a book 12 by 18 the most desirable size for records of this kind.

Third.—I would prefer forms printed on heavier paper.

Fourth.—I prefer them in book form and a book for each class of structure and record to be continued in same book from year to year indefinitely.

Fifth.—There should be a space on heading of page to show date of record and more space allowed in some columns for description; also a column at the end of the page to show when the structure was destroyed, rebuilt, or removed.

Mr. H. M. Henson of the Chesapeake & Nashville Railway would make the blanks 10 by 14 inches in size and would use heavier paper.

Mr. A. H. King of the Oregon Short Line Railway suggests that there is a lack of proper space on some of the blanks for noting minor changes; also that heavier paper be used and the record be made up in book form.

Mr. D. C. Zook of the Pennsylvania Company has the following to say regarding the blanks:

First.—The blanks headed "Record of Buildings," "Record of Turn-tables and Pits," "Record of Engine Houses," "Record of Track and Station Scales," "Record of Coaling Stations" are admirable, and I do not see that anything could be added to or taken from them; they certainly give in a condensed form all the information needed, and would meet all the requirements of the Pennsylvania Company.

From the blank headed "Record of Stock Pens" the spaces for Branding and Dehorning could be eliminated; in our country it is not necessary to do any of this.

From the "Record of Water Stations" the spaces for Towers and Wind Mills could be eliminated; we have no forms for keeping these records. They are usually kept in book form and written out to meet the requirements of the case.

Second.—The size of the forms submitted, 10 by 16½, seems to me to be a good size, as they are about double the size of a

common letter sheet and can be folded, if necessary, to half size.

Third.—Personally, I would prefer the forms printed on thin paper similar to the sample, as in that case prints could be made for the officials.

Fourth.—I would prefer the loose-leaf record system in a Shipman binder, so the sheets could be removed in case a print of them is desired.

Charles Carr, Michigan Central Ry., Jackson, Mich.:

First. The blanks submitted appear very complete, and in a general way would answer our purpose, going into details in some respects more than we do. We have no prepared blanks, but keep a loose-leaf record on sheets of a uniform size (as per sample sheets enclosed) of all buildings, pipe lines, scales, street gates, etc. We give an important building an entire sheet (or more if necessary), on which is noted information relative to the size and construction of the building (the tracing or plans showing details being filed separately and filing number indicated on sheet). All important additions or alterations are made a matter of record on these sheets and when necessary another sheet is inserted to continue the record. These sheets are filed alphabetically, and any information desired which is a matter of record can be found in a moment.

Second. Have no opinion as to size of forms.

Third. Think heavier paper would be more durable.

Fourth. Prefer loose-leaf record.

Ed. Gagnon, M. & St. L. Ry. Co., Minneapolis, Minn.:

First. The blanks submitted would answer all requirements on this road.

Second. Size of form preferred, 23 x 26, double page.

Third. Prefer heavy paper. (See my note below reference copies for other officials.)

Fourth. Do not favor loose-leaf record system. Prefer bound in book form.

Referring to my bracketed notation in answer to third query, I am not in favor of furnishing copies of entire record to officials outside of engineering and buildings departments, and my experience is that they are not wanted by other officials in that form, being lacking incompactness and the usually looked-for information not being discernible at a glance. My practice has been for the last few years to get out typewritten sheets from the records once a year, eliminating such parts as are of no use to other departments, and furnish a set of prints therefrom to each head of departments, who can then make requisition for

any number of copies which may be required. These sheets are generally gotten out in station rotation, and are handy for general information reference. I attach a couple of sample prints from such sheets.

On smaller railroads a general building record by stations in usual time-table rotation would perhaps be preferable to the classified forms submitted with your letter, or still better, if the style of bridge record used allows it, the building record may be kept opposite the stations generally enumerated in that record. If you think such form would interest your committee, I can furnish on request. Of course you will understand that the last two forms of record suggested could not take the place of the admirable forms submitted, and only refers to smaller systems where the necessity does not exist for an extensive classified record.

F. L. Park. C., R. I. & P. Ry., Topeka, Kan.:

I consider this set of blanks very complete in all details and should think that they would meet the requirements of any road providing the persons who were furnished with copies of this had a complete file of plans or access to the same; otherwise from that I rather favor the system we are using on this road, which is this: The engineering department takes a blank such as the sample I am sending you herewith and enters upon it all structures at any one station, and then showing a ground plan of station grounds and structures on bottom of sheet, drawn to a small scale, and same is blue printed and furnished to various heads of departments needing same. I favor this plan for the reason that if any additions or removals are made in any structure, that party having file of these reports can check same off on his file which gives him a complete record without the trouble of rearranging his file. I am unable to send you anything but this blank form, as our engineering force is limited and it would be several days before I could get a copy to send to you, but I think you will understand from my description the point which I wish to raise. Of course at any terminal or large station where one or more of these plans will not give room for ground plan of all structures, they divide the structures by placing part on one or more sheets as the case may be. Replying to your questions:

First. Think these forms would meet all requirements on this road, unless for reasons as stated in the foregoing.

Second. I consider the size of these forms very desirable and do not see that they can be improved upon.

Third. I think the form should be furnished on the thin paper sample same as you have submitted, for the reason that then there can be any number of prints taken to compile the files from for various officers.

Fourth. I would prefer the blank to be bound in book form after being printed.

J. N. Penwell, L. E. & W. Ry. Co., Tipton, Ind.:

First. The blanks submitted would meet any requirements of our road and in fact furnish more information than we keep on any printed forms. Our forms are not as thorough as yours but I enclose herewith a blank form which we use. In addition to the enclosed report I keep a memorandum of size of doors, glass, height of ceilings, etc. This is kept in regular memorandum books.

Second. The size of forms submitted with your circular letter are all right. I would consider it the most practical size.

Third. I would recommend forms to be printed on thin papers similar to the blanks submitted so that other prints can be taken from them. It would also take less space in the files.

Fourth. I have never used a loose-leaf record system but have been considering it and I believe that it will be the best plan. Records could be then revised much easier than if printed in book form.

CONCLUSION.—It is the understanding of your committee that the record blanks on which it is to report are for the purpose of recording detailed information in regard to buildings, water tanks, engine houses, and other station facilities; these records being especially for the use of men who actually have to do with the construction and maintenance of the structures and not necessarily for general distribution among the various officials of the operating department. The blank forms in use on the C. & N. W. Ry., which are herewith submitted, while not suitable for all purposes, are sufficiently complete to enable each member of the Association to design blanks which will be suitable for the particular line of railway on which he is employed, and the committee have not considered it advisable to attempt devising blanks that would be suitable for all purposes.

The C. & N. W. Ry. blanks are in size 10 inches x 16½ inches, or double the ordinary business letter head, so that if desired they can be folded and filed in the ordinary letter file; or they can be bound in book form as is desired. They are printed on thin paper and can be blue printed if desired to furnish copies for the use of officials who may have occasion to refer to records of this kind. We also submit copies of record blanks in use on the Michigan Central Ry., Minneapolis & St. Louis Railroad, Colorado & Southern Ry., Chicago, Rock Island & Pacific Ry., and the Lake Erie & Western Ralroad.

B. J. SWEATT,
B. F. PICKERING,
A. SHANE.
I. O. WALKER,
J. F. WHITE,
WM. E. HARWIG,
Committee.

Blanks submitted with letter of Charles Carr, Superintendent of Buildings of the Michigan Central Railroad at Jackson, Mich., forwarded with report on "Best Record Forms for Buildings, Water Tanks, Etc.": blank No. 1 gave record of passenger station at Grosse Isle on that railroad ; blank No. 2 gave record of water tank and pump house.

[Form No. 1.]

Grosse Isle Passenger Station :

Built by contract ; Charles Ufford, contractor,
Building completed in October, 1903.
Size of building, 26 x 50 ft. ; 12 ft. high from foundation to top of wall ; 13 ft. high to ceiling.
Foundation walls of concrete ; walls of paving blocks and Roman brick (Hocking Valley Nelson paving blocks).
Roof slated with best quality Pennsylvania black slate, 8 inches x 16 inches, laid 7 inches to the weather ; ridge and hips No. 24 galv. iron ; pitch of roof, $\frac{2}{3}$.
Inside closets for men and women.
(Plan and specifications showing all details filed. File G, 260.)
Heating plant put in by the M. C. R. R.
Invincible steam heater No. 335.
Station equipped with a gasoline device (manufactured by "The Incandescent Light and Stove Company," of Cincinnati, Ohio. Installed by Lang & Dixon, agents ; cost, $91.65. See bill Oct. 31, 1903).

Cost—contract price of station	$0,000.00
steam heater with pipe, etc.	000.00
lighting (contract)	00.00
furniture	00.00
sewer and lawn water-works	00.00
inspection	000.00
Total	$0,000.00

May 30, 1904.

Brick platform laid around station. See sketch filed G, 261 ; first quality Saginaw paving brick.

Cost—labor	$000.00
material	000.00
Total	$000.00

[Form No. 2.]

Grosse Isle Water Tank :

Erected in August, 1902.

Standard 88,000 gallon tank.
Cypress tub, 30 ft. bottom, 18 ft. staves ; hooped in standard manner (Winship Mfg. Co. lugs), prepared gravel roof, arrow brand.

Foundation, concrete, 12 piers.
Substruction, 12 post Larimer steel, 30 ft. elevation.

Cost—material,	foundation	$000.00
	substructure	000.00
	tub	000.00
labor		000.00
Total		$000.00

Pump House :

Built in August, 1902. Tracing G, 259, filed.

Size, 14 x 18 ft. ; 12 ft. to top of plates.
Foundation, concrete.
Frame building, outside covered with german siding, inside sheeted, covered with tarred paper, and ceiled ; prepared gravel roof.

Cost—material	$000.00
labor	000.00
Total	$000.00

20 H. P. Fairbanks, Morse & Co.'s combined pumper, shop number 00,000, suction 6 inches, discharge 6 inches.
Pump set on concrete foundation.

Cost of pump	$000.00
Cost of foundation and setting pump	000.00
Total	$000.00

Pump placed in service Sept. 1, 1903.

Blanks submitted with letter of Ed. Gagnon, Supervisor Bridges and Buildings, Minneapolis & St. Louis Ry. Co., forwarded with report on "Best Record Forms for Buildings, Water Tanks, Etc.," by Committee No. 9. Blank No. 1 gave record of station facilities such as buildings, sheds, water tanks, etc., as, also, blank No. 2 of stations in rotation order.

[Form No. 3.]

MINNEAPOLIS AND ST. LOUIS RAILROAD COMPANY.

STATION TRAFFIC FACILITIES.

B. and B. Department, January 1st, 1904.

LOCATION.	STRUCTURE.	KIND.	SIZE.	CAPACITY.	CONDITION.	REMARKS.
St. Paul	Ice-house.	Wood	18x36	200 T.	Good.	
Minneapolis:						
Western Ave.	Turn-table.	Wood	50 feet	80 T.	Good.	
	Tank	Wood	12x14	City wat'r	Good.	
	Ice-house	Wood	Dbl.26x58	1,000 T.	Good.	
Cedar Lake	Roundho'se	Brick		27 stalls	Good.	15 stalls latest addition.
	Turn-table.	Steel	70 feet	125 T.	Good.	
	Coal hoist	Crane		10 cars	Poor.	Shed 18-50-7; 22 (?) buckets.
	Sand house	Wood	20-40-10.	25 cars	Poor	
	Tank	Wood	16x24	50,000 G	Good.	6-inch water column; Poage.
	Tr'k scales.	Fairba'ks	42 feet	100 T.	Good.	
Eden Prairie	Tank	Wood	16x24	50,000 G	Good.	Gaso. plant.
Carver	Tank	Wood	16x24	50,000 G	Good.	Gaso. plant.
Merriam	Coal chute	Standard.	12 P	4 cars	Fair	186-foot track.
Jordan	Tank	Wood	16x24	50,000 G	Good.	Gaso. plant.
New Prague	Wat. sup'ly	Siphon			Good.	Emergency for delayed engines; supply from mill pond.
Montgomery.	Tank	Wood	16x24	50,000 G	Good.	Gaso. plant.
Waterville	Coal dock	Wood	3-7-38 ft.	1 car	Good.	
	Tank	Wood	16x24	50,000 G	Good.	Gaso. plant; 2 10 inch S. ef. water column.
N. Richland	Tank	Wood	16x24	50,000 G	Good.	Gaso. plant.
Albert Lea	Roundho'se	Cem't blk.	Stand'd	15 stalls	Good.	
	Turn-table.	Steel	70 feet	175 T.	Good.	
	Coal chute	Standard.	24 P	7 cars	Good.	247-foot track.
	Sand house	Wood	Small	1 car	Poor	New sand house and water system under construction.
	Tank	Wood	16x24	50,000 G	Fair	

[Form No. 4.]

MINNEAPOLIS AND ST. LOUIS RAILROAD COMPANY.

FACILITIES FOR HANDLING STOCK AT STATIONS.

B. & B. Department, January 1st, 1904.

LOCATION.	COMPARTMENTS AND SIZES.	SHEDS.	PAVED.	WATER.	SCALES.	WETTING STOCK IN TRANSIT.
Chaska........	4-32x32......	4	Stone ...	W.&Hd.P.	Fbk. 4 T.	No.
Carver	2-32x32......	1	No......	Tank Con.	No.......	Yes.
Jordan........	2-32x32......	2	No......	W.&Hd.P.	Fbk. 4 T.	Yes.
N. Prague....	2-48x48......	2	Brick...	W.&Hd.P.	Fbk. 4 T.	No.
Montgomery..	4-32x32......	2	Brick...	Quirk M...	Fbk. 4 T.	Yes.
Kilkenny......	4-32x32......	2	Stone ...	City Con..	Fbk. 4 T.	No.
Waterville....	4-32x32......	4	Stone ...	Tank Con.	Fbk. 4 T.	Yes.
Waseca.......	4-32x32......	4	Brick...	W.&Hd.P.	Fbk. 8 T.	No.
Otisco..... ...	2-48x48......	2	No......	Wind M...	Fbk. 4 T.	No.
New Richland	4-24x48......	4	Brick...	Tank Con.	Fbk. 4 T.	Yes.
Hartland......	4-24x48.....	4	Brick...	W.&Hd.P.	Fbk. 4 T.	No.
Manchester...	1-32x32......	2	Brick...	W.&Hd.P.	Fbk. 4 T.	No.
Albert Lea.... C.R.I. & P.....	7 pens; 12,-000 sq. ft.	4	Conc'te & stone.	Tank Con.	Chic. 4 T.	No.
Twin Lakes...	2-48x48......	2	Stone ...	W.&Hd.P.	Fbk. 4 T.	No.
Emmons......	2-32x32......	1	No......	No.........	Fbk. 4 T.	No.
Norman.	4-24x48......	2	No......	W.&Hd.P.	Fbk. 4 T.	No.
Lake Mill.....	4-32x32......	4	Stone ...	Tank Con.	Fbk. 4 T.	Yes.
Leland........	4-24x28......	4	Stone ...	W.&Hd.P.	Fbk. 4 T.	No.

[Form No. 5.]

COLORADO & SOUTHERN RAILWAY COMPANY.

STRUCTURES.

Location.	Distance from Denver.	Number.	Sixth District. Walsenburg to Trinidad. Name or Description of Structure, No. and Size of Rooms, Sq. Ft. of Platform Cap'y of Tank.	No. of Stories.	Foundation.	Structure.	Dimensions in feet. Width.	Length.
Ludlow......	207.7	....	Combination depot......	1	Wood	Frm	22	48.6
			Office 10.8x11.6					
			Waiting room, 10.8x14					
			Freight room, 9.6x22					
			2 rooms each, 10.8x11					
			1 room, 10.8x11.6					
			1 room, 10.8x14					
			Platform, 2,552 sq. ft					
			Oil and supply house	1	Wood	Frm	10	12
			Bunk house...........	1	Wood	Frm	14	22
			Water closet..........	1	Wood	Frm	5	6
Acme........	201.0	....	Water station............					
			Tank. 16x24					
			Pump house............	1	Wood	Frm	10	14
			Fairbanks, Morse & Co., duplex pump, 6x5x6.					
			Upright boiler, 8x7					
			Water supply well, 17x25.					
			Coal platform, 14x14					
Lynn........	200.0	....	Combination depot......	1	Wood	Frm	22	38
			Office, 10.8x11.6					
			Freight room, 11x14					
			Waiting room, 10.8x11					
			One room, 10.8x11					
			One room, 10.8x11.6					
			One room, 10x14					
			Platform, 2,378 sq. ft......					
			Coal platform, 10x14					
			Water closet.	1	Wood	Frm	5	6
			Section house............	1	Wood	Frm	20	50
			Addition................	....	......	......	14	20
			Sitting room, 14x19					
			Dining room, 16x19					
			Bed room, 9x18					
			Kitchen, 9x18					
			Bunk room, 19x20					
			Water closet............	1	Wood	Frm	5	
			Tool house	....	....	Frm	10	20
Monson	192.0	....	Water station............					
			Tank, 16x24					
			Pump house...	1	Wood	Frm	10	14
			Fairbanks, Morse & Co., Duplex pump, 6x5x6.					
			Upright boiler, 8x7					
			Water Supply well, 17x45.					
			Coal platform, 14x14					

Blank submitted with letter of F. L. Park, Master Carpenter C., R. I. & P. Ry., at Topeka, Kan., forwarded with report on "Best Record Forms for Buildings, Water Tanks, Etc.," by Committee No. 9. Blank gave record of all structures and station facilities.

[Form No. 6.]

(NAME OF LINE.)

STATION .... DIVISION .... STATE .... COUNTY ....

Date Built.	Description of Building.	Plan No.	No. of Stories.	Dimensions.	Material.	Kind of Roof.	Cost.	Remarks. Name of builder, A. f, e No., how heated, if joint property, give names of owners, etc.

Blanks submitted with letter of J. N. Penwell, Supt. B. & B., Lake Erie and Western Ry. Co., forwarded with report on "Best Record Forms for Buildings, Water Tanks, Etc.," by Committee No. 9. Blank No. 1 gave record of all facilities at one station, New Castle. Blank No. 2 gave record of track scales at stations in rotation order. Blank No. 3 gave record of roundhouses at stations in rotation order. Blank No. 4 gave record of turn-tables at stations in rotation order. Blank No. 5 gave record of ash pits at stations in rotation order. Blank No. 6 gave record of water tanks at stations in rotation order. Blank No. 7 gave record of pump houses at stations in rotation order.

[Form No. 7.]

RECORD OF ALL FACILITIES AT ONE STATION.

Name.	Construction.			Size.			Date.	Condition.	Value.	Remarks.
	Building.	Foundat'n.	Roof.	L.	W.	H.				
New Castle.										Population, 3,406.
Hand-car house......	Frame ..	Stone	Shingled	20	16	12	1882	Good. ...	$150	
Turn-table..........	....	Timber....	....	50	......	......	....	Poor	300	Greenleaf, C. I.
Coal dock............	Frame ..	Piling	....	130	28	13	1897	Good.....	500	6 dump cars.
Coal heavers' house..	Frame ..	Piling	Shingled	12	10	9	1884	Poor	20	
Water tank..........	....	Stone	Shingled	......	......	......	1882	Poor	200	Tub 16x24 ft. wood frame.
Track scales.........	....	Stone	....	45	......	......	1901	Good.....	1,050	Buffalo, 80-T.
New Castle Junc.										
Mt. Summit.										

[Form No. 8.]

TRACK SCALES, MAIN LINE.

STATION.	Location.	Length.	Capacity.	Condition.	Maker.	Value.	Remarks.
Sandusky, Ohio	West end of yard	34 feet	30 tons	Poor	Fairbanks	$100.00	Raised to 50 tons.
Fostoria, Ohio	100 ft. west of B. & O.	34 feet	30 tons	Fair	Fairbanks	400.00	Raised to 50 tons.
Lima, Ohio	West end of yard	45 feet	30 tons	Good	Buffalo	1,150.00	Raised to 50 tons.
Celina, Ohio	First street east of depot	45 feet	30 tons	Good	Buffalo	1,050.00	North of main track.

[Form No. 9.]

ROUNDHOUSES.

LOCATION.	Kind of Structure.	Foundation.	Roof.	No. of Stalls.	Length of Stalls.	Kind of Smoke Jacks.	When Built.	Value.	Lengths of Pits.	Remarks.
Sandusky, Ohio	Brick	Brick	Gravel.	7	74 feet	Wood	1892	$3,500.00	46 feet	
Findlay, Ohio	Brick	Stone	Slate	1	58 feet	19 wood	1872	500.00	30 feet	
Lima, Ohio	Brick	Stone	Slate	25	64 feet	6 terra cotta	1880-'99	8,000.00	46 feet	Has gable roof.
Muncie, Ind	Brick	Stone	Slate	4	66 feet	Terra cotta	1878	1,200.00	50 feet	Has gable roof.

[Foam No. 10.

TURN-TABLES.

LOCATION.	Kind of Structure.	Kind of Foundation.	Coping.	Kind of Circle Foundation.	Length.	Date Built.	Value.	Maker.	Remarks.
Sandusky, Ohio	Steel	Stone	Concrete.	Concrete.	62 feet.	1901	$2,800.00	King Bridge Co.	
Fostoria, Ohio	Steel	Stone	Stone	Gravel	60 feet.	1899	2,000.00	King Bridge Co.	
Lafayette, Ind.	Steel	Stone	Stone	Stone	50 feet.	1895	1,700.00	King Bridge Co.	
Rankin, Ill	Steel	Stone	Stone	Stone	68 feet.	1892	2,600.00	King Bridge Co.	

[Form No. 11.]

ASH PITS.

LOCATION.	Kind of Structure.	Length.	Width.	Depth.	When Built.	Value.	Remarks and Method of Handling.
Sandusky, O..	Stone and iron.	46 feet.	11 feet.	4 feet.	1892	$1,400.00	Cars run down into pits. Shoveled in car.
Muncie, Ind...	Brick...........	24 feet.	4 feet.	4 feet.	1898	100.00	Shoveled from pit and then into cars.
Tipton, Ind...	Stone and iron.	46 feet.	11 feet.	4 feet.	1892	1,400.00	Shoveled direct into cars placed in pit.
Peoria, Ill.....	....	....	....	....	....	....	Use P. & P. U. terminals.

[Form No. 12.]

WATER TANKS.—STAND-PIPES.

LOCATION.	Size.	Capacity.	Kind of Foundation.	Kind of Frame.	When Built.	Condition.	Value.	Remarks.	Size.	Maker.	Remarks.
Sandusky, O....	16x20	35,280	Stone.......	Wood....	1903	Good.....	$1,800.00		6 in.	J.N. Poage	
Findlay, O.......	12x12	56,000	Stone.	Wood....	1895	Fair......	600.00		......	....	
Bluffton, O......	16x24	56,000	Stone.......	Wood....	1895	Fair......	400.00		......	....	
Portland, Ind...	16x24	56,000	Wood......	Wood ...	1901	Good.....	1,400.00		6 in.	J.N. Poage	

[Form No. 13.]

PUMP HOUSES.

LOCATION.	Size.	Kind of Structure.	Kind of Foundation.	When Built.	Condition.	Value.	Remarks.
Buckland..................	14x18½ feet.	Frame.........	Wood..........	1877	Good.......	$155.00	
Celina......................	12x14 feet.	Frame.........	Wood..........	1879	Poor.......	Worthless.	
Chase.......................	12x22 feet.	Frame.........	Wood..........	1891	Good.......	200.00	
Rankin.....................	10x22 feet.	Frame.........	Wood..........	1898	Good.......	100.00	Enlarged in 1903.

[Form No. 14.]

CHICAGO & NORTH WESTERN RAILWAY COMPANY

NOTE—*Names* of *all* Buildings to be recorded on this form.
If description of Building is covered on another form, it is to be so noted.

RECORD OF

Number of Diagram.	Location and Name of Buildings.	Year Built.	Plan Reference.	Buildings.									
				Width.	Length.	Height.		Material.		Roof.		Floor.	
						Rail to Floor.	Floor to Plate.	Foundation.	Above Foundation.	Pitch.	Kind.	Sub.	Finish.
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....

[Form No. 15.]

MISCELLANEOUS REMARKS, RECORD OF ADDITIONS, ETC.

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[Form No. 16.]

CHICAGO & NORTH WESTERN RAILWAY COMPANY

RECORD OF TRACK

Location.	Year Built.	Plan Reference.	Maker.	Capacity, Tons.	Size of Platform.		Lin. ft. Rail.		Size of House.	Kind of Scale Foundation.	Drainage.		Weighing Attachment.	Original Cost.
					Width.	L'gth.	Dead Rail.	Live Rail.			L'gth.	Empties Into.		
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

.... DIVISION.

BUILDINGS.

Form No. 1429.—A, Building Record.

Buildings.—Continued.									Platforms.							
Chimneys.							Drainage.		Size.			Kind.				
No.	Kind.	Flues.	Heating.	Lighting.	Water Supply.	Plumbing.	Length.	Empties Into.	Length.	Width.	Height above Top Rail.	Surface.	Curb.	Total Area, Sq. Ft.	Area of Covered Plat., Sq. Ft.	Original Cost.
..	......	......	......	......	......	......	......	......	....	....	....	....	....	....	....	....
..	......	......	......	......	......	......	......	......	....	....	....	....	....	....	....	....
..	......	......	......	......	......	......	......	......	....	....	....	....	....	....	....	....
..	......	......	......	......	......	......	......	......	....	....	....	....	....	....	....	....

Form No. 1429 A.—A, Building Record.

Sketch of Location of Buildings.

.... DIVISION.

AND STATION SCALES.

Form No. 1427.—B, Building Record.

Location.	Year Built.	Plan Reference.	Maker.	Capacity, Tons.	Size of Platform.		Lin. ft. Rail.		Size of House.	Kind of Scale Foundation.	Drainage.		Weighing Attachment.	Original Cost.
					Width.	L'gth.	Dead Rail.	Live Rail.			L'gth.	Empties Into.		
....	...	....	....	....	......	......	.....	.....	......	....	......	....	....	....
....	...	....	....	....	......	......	.....	.....	......	....	......	....	....	....
....	...	....	....	....	......	......	.....	.....	......	....	......	....	....	....
....	...	....	....	....	......	......	.....	.....	......	....	......	....	....	....

[Form No. 17.]

CHICAGO & NORTH WESTERN RAILWAY COMPANY

RECORD OF WATER

Location.	Water Tank.										Stand Pipes.								
			Size of Tub.				Distances.				Pit.				Pen Stock.				
								Top Rail to											
	Year Built.	Kind of Foundation.	Diam.	H'gt.	Capacity, Gallons.	Diam. Tank Outlet.	C. Tk. to Face Board.	Cent. Outlet.	Bot. Tub.	Frost Box.	Width.	Length.	Depth.	Material.	Kind and Maker.	Diam. of Pipe.	Diam. of Supply Pipe.	Cent. Track to Cent.	Top of Rail to Cent. Hor. Pipe.

[Form No. 18.]

CHICAGO & NORTH WESTERN RAILWAY COMPANY

RECORD OF

Location.		Year Built.	Plan Reference.	Size.			Capacity in Carloads 600 sq. ft. Each.	Sheds.		Paving.		Troughs.		Feed Racks.		Number of Chutes.				
Name of Station.	Which End of Yard.			No. Pens.	Width.	Length.		No. Pens.	Kind.	No. Pens.	Kind.	No. Pens.	Kind.	No. Pens.	Kind.	Cattle Loading.	Double Deck Loading.	Hog Unloading.	Branding.	Dehorning.

.... DIVISION.

STATIONS.

Form No. 1430.—D, Building Record.

Pumps.														Towers.			Wind Mills.		
					Size.			Suction Pipe.		Dischg. Pipe.		Steam Pipe.							
Date Installed.	Make of Pump.	Kind, Steam Power or Hand.	Steam Expansion, Simple, Comp.	Action Single, Double, Triple.	Steam.	Water.	Stroke.	Size.	Length.	Size.	Length.	Size.	Length.	Year Built.	Kind.	Height.	Year Built.	Kind.	Diameter.

.... DIVISION.

STOCK YARDS.

Form No. 1428.—C, Building Record

Scales.								Water supply.													
		Size of Platform.		Size of House.				Source.		Power.			Tower.		Tank.						
Kind.	Capacity, Tons.	Width.	Length.	Width.	Length.	Kind of Foundation.	Owned By.	Kind.	Size.	Kind.	Size.	Water Cylinder.	Height.	Kind.	Diam.	Length Stave.	Capac. Gals.	Average Annual Shipment, Car-loads.	Original Cost.		

[Form No. 19.]

CHICAGO & NORTH WESTERN RAILWAY COMPANY

RECORD OF COALING

LOCATION.	Year Built.	Plan Reference.	STORAGE COAL REHANDLED FOR LOCOMOTIVE DELIVERY.								APPROACH.			
			Description of Shed.							Description of Hoisting Apparatus.	Kind.	Foundation.	Length.	Grade.
			Width.	Length.	Height, Main T'k Rail to Plate.	Capacity, Tons.	Kind of Foundation.	Roof.						
								Date.	Kind.					
....	......	......	......	......	......	......	......	......	......	......	......	......	......	......
....	......	......	......	......	......	......	......	......	......	......	......	......	......	......
....	......	......	......	......	......	......	......	......	......	......	......	......	......	......
....	......	......	......	......	......	......	......	......	......	......	......	......	......	......

[Form No. 20.]

CHICAGO & NORTH WESTERN RAILWAY COMPANY

RECORD OF TURN-TABLES

LOCATION.	TURN-TABLES.												
	Year Built.	Plan Reference.	Length.	Style.	Material.	Maker.	Dist. Below Base Rail.		Foundation Material.			Method of Operation.	Date Painted.
							To Top Center Stone.	To Top Circle Rail.	Pit Walls	Circle.	Center.		
....	......	......	......	......	......	......	......	......	......	......	......	......	......
....	......	......	......	......	......	......	......	......	......	......	......	......	......
....	......	......	......	......	......	......	......	......	......	......	......	......	......
....	......	......	......	......	......	......	......	......	......	......	......	......	......

....DIVISION.

STATIONS. **Form No. 1426.—E, Building Record**

Delivery Direct to Locomotives.																
Description of Sheds.											Description of Elevating Machinery.	Delivery Chutes.		Fire Protection.	Original Cost.
Width.	Length.	Height.	Capacity, Tons.	Kind of Foundation.	Main Tk. Rail.		Clearance.		Roof.			No.	Kind.		
					To Elev. Rail.	To Chute Hinge.	Width.	Height.	Date.	Kind.					

....DIVISION.

AND CINDER PITS. **Form No. 1425.—F, Building Record.**

				Cinder Pits.										
Date Deck Renewed.	Drainage.		Original Cost.	Year Built.	Plan Reference.	Length.	Material.			Method of Handling Cinders.	Kind of Hoist.	Drainage.		Original Cost.
	Length.	Empties Into.					Track Rail Supports.	Side Walls.	Floor.			Length.	Empties Into.	

[Form No. 21.]

CHICAGO & NORTH WESTERN RAILWAY COMPANY

RECORD OF

Location.	Year Built.	No. Stalls.	Plan Reference.	Inside Radius or Width.	Length Outside Walls.	Center to Cent. T'ks.		Height Top Rail to Top of Plate.			Wall Material.		Roof.			Kind of Floor in House.
						Front.	Rear.	Front.	Cent.	Rear.	Foundation.	Above Foundation.	Date.	Pitch.	Kind.	

[Form No. 22.]

CHICAGO & NORTH WESTERN RAILWAY COMPANY

RECORD OF MISCELLANEOUS

Location.	Date Built.	Kind of Structure.	Size.	Description.	Original Cost.

.... DIVISION.

ENGINE HOUSES. **Form No. 1424.—G, Building Record.**

Pits.					Ventilators.		Engine Smoke Jacks.			Chimneys.			Heating.	Lighting.	Water Supply.	Plumbing.	Drainage.		Original Cost.
No.	Length Inside.	Walls.	Coping.	Floor.	No.	Kind.	Date.	No.	Kind.	No.	Kind.	Size of Flue.					Length.	Empties Into.	

.... DIVISION.

PROPERTY. **Form No. 1423.—H, Building Record**

LOCATION.	Date Built.	Kind of Structure.	Size.	Description.	Original Cost.

[Form No. 28.]

IMPROVEMENTS ON PLANT OF C. & N. W. RY. CO. AT ...., ...190 .

DETAILED DESCRIPTION.

DEPOT.

Distance from center main track,
Distance from center side track,
Lineal feet of front platform,
Plank, Cinder,
Brick, Crushed stone,
Asphalt platform,
Height of platform above top of rail,
Height of depot floor above platform,
How heated,

Stock Yard.

No. of pens, Lin. ft. sheds,
Capacity of scales,
How is water supplied,

Turn-table.

Kind, Length,
Diameter of pit,
Distance base of rail to top of ct. stone,
Distance base of rail to top of circle rail,
Maker's name,
Date installed,
Material in pit wall,
Material in center foundation,
Material in circle rail foundation,
Method of operation,

Water Tank and Connections.

Center of track to face board of tank,
Top of rail to center of outlet,
Capacity of tank,
Source of water supply,
Well diam., Depth,
Height from water to top of tank,
Windmill—kind,
Tower—kind,
W. M. pump—kind, Size,
Steam pump—kind, Size,
Diam. cylinder—steam, Water,
Diam. pipe—suction, Disc,
Length pipe—suction, Disc.
Gasoline engine,

Pump House.

Stand Pipe.

Stand pipe—kind,
Stand pipe—size, Height,
Stand pipe—distance from track ct.,
Supply pipe—size,

Track Scale.

Kind,
Capacity,
Lin. ft. dead rail, Live rail,

Sand House.

Size,
Capacity,
How equipped,

Engine Coal Shed.

Crane houses—No., Size,
Lin. ft. of shed proper,
Number of buckets,
Cars—No.,
Number of pockets,
Trestle approach, Lin. ft.

Engine House.

Stalls—No., Clear length,
Kind of jacks,
Number of ventilators,
Materials in detail are—
Roof, Walls,
Floor, Pit walls,
Pit floor,
How heated,

Cinder Pit or Cinder Hoist.

Length,
Material in pit wall, Pit floor,

Machinery Derrick.

Diam. of mast,
Reach,
Size of platform,

Oil House.

Size,
Number of tanks,
Capacity—gallons,
Kerosene, Black oil,
Signal oil, Valve oil,

LIST.

Names.	Year built.	Dimensions.	Materials.	Value.
Depot,				
Station C. & O. House.				
Station Out House,				
Stock Yard,				
Engine Coal Shed				
Water Tank,				
Pump House,				
Wind Mill,				
Wind Mill Tower,				
Turn-table,				
Engine House,				
Machinery Derrick,				
Track Scale,				
Section Dwelling,				
Section Tool House,				
Cinder Hoist,				
Sand House,				
Elevator,				
Warehouse,				
Ice-house,				
Machine Shop,				

Issued by the Engineering Dept.,
Annual correction made,

DISCUSSION.

President.—This committee has a very complete report, which is quite long. I think it will not be necessary to read it. Messrs. Sweatt, Harwig and Shane, I think, are the only members of that committee present.

Mr. Shane.—I have nothing further to offer on this subject. The chairman of this committee compiled the report and accumulated the information, and it has been printed so that all can read it, but in order to start any discussion that we may have I would suggest that any member who desires further information arise and make inquiry as to the point he wishes brought out.

Mr. Sweatt.—I have nothing further to add to our committee report.

X.—Best Freight and Roundhouse Doors, and Fittings for Same.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

Freight House Doors: The door in common use is a wooden, panel door, moving horizontally, hung by attaching two wheels to top of door to run on track fastened to the wall; when open the door is boxed in. This kind of door gives good satisfaction and cost of repairs is small. There are a great many different kinds of hangers on the market; the most suitable for this kind of door will be anti-friction, have lateral and vertical adjustments, and be made of wrought or malleable iron. This kind of door will be cheap, give good satisfaction to the men handling them, and require very little repairs.

When it is desirable to use doors with a vertical movement, they will be found satisfactory when hung with large sheaves (10 to 14 inches in diameter) and strong cable, with counter weights made for the purpose.

The door with vertical movement has the advantage of not being interfered with by snow and sleet so much as the door with the horizontal movement. On the track side of the freight house the vertical-moving door will be found best, as this will allow the wall to be practically all doors and will fit any length of car. When the building will not give head room for vertical-moving doors, the Harrington trolley hangers give good satisfaction and give a door in front of every car door.

Roundhouse Doors: The wood panel, square-top door, with three (3) or four (4) hinges, with as little glass as possible, is the best. The doors should have good clearance at the bottom —not less than two inches—as most roundhouse doors are sprung and warped out of shape by crowding them over the ice and heaved track in winter.

To hold the doors open, a post with a latch is the common practice, and is very good. Gas-pipe posts, connected at the top, make a good arrangement to fasten the doors open, and hold them in position against winds and warping.

To fasten the doors when closed, the old-fashioned bar across the doors is best.

In connection with the report we do not consider it necessary to send plans or sketches. We have several letters from manufacturers, stating that they will be represented at the convention, and be prepared to illustrate their particular kind of door hangers.

John I. Banks,
Chairman,

J. McIntyre,
R. K. Ross,
E. M. Gilchrist,
G. W. Walker,
Committee.

DISCUSSION.

The discussion was started by Mr. Rettinghouse, who presented and read as part of his remarks a report prepared by a committee of the Chicago & North Western Railway on the subject of Roundhouse Doors.

The question of the advisability of mentioning names of manufacturers of patented articles or directly referring to patented articles in the proceedings of the Association was raised by Mr. Burrell, who was supported by Mr. Shane.

Messrs. Reid, Killam and Andrews considered it proper to refer to the names of good articles but did not consider that the proceedings should be the medium of discrediting articles.

Messrs. Cummin, Sheldon, Andrews and Shane considered that the precedents established and methods followed heretofore in the published proceedings had proved to be correct and for the best interest of the Association and that no doubt the same rule would follow in the future proceedings.

Mr. A. S. Markley then made announcement in regard to arrangements for the trip to St. Louis.

Mr. Rettinghouse.—We have investigated the door matter in connection with roundhouses on our road and have found that the steel roller doors have not been giving the satisfaction desired. (Mr. Rettinghouse then read extracts from a report on the subject prepared by a committee of the Chicago & North Western Railway.)

Mr. E. D. B. Brown.—I do not see that the committee in its report has mentioned one class of door for roundhouses or freight houses, and that is a door which is manufactured by two firms, the name of one of the doors being the Cross Horizontal Folding door and the other the Wilson door. We have used the Cross Horizontal Folding doors and find them very satisfactory in freight house work. They fold horizontally and can be made so that the door will be made to break at a point three fourths of the total height or at

a point two thirds of the total height of opening, as the case may require. The space left at the rear of the tank in roundhouses will allow of the door folding without interfering with the tank if the door is cut three fourths and one fourth. It can be folded up and form a hood outside of the door opening, which, in case of a gutter on the roof leaking, protects the entrance thoroughly. Being made of wood, it is more indestructible from deterioration than the steel rolling door, and makes a very good substitute for any of the older doors used in roundhouse construction. One of our late freight houses is fitted with 80 of these Cross Horizontal Folding doors, three of which are large track doors and are 22 feet wide by 18 feet high. One of them is five inches thick, yet I have seen a man weighing 110 pounds operate that door without any trouble. They operate nicely, close down to the floor very close and lock securely. We worked out the clearance that this door would take in folding up and found that it was practically the same as if barrel or bag freight were piled up back of the door. As new manufacturers take up this style of door they will not be controlled by one or two companies and the price will gradually come down to the price of the ordinary wooden swinging door, which does not cost over 40 cents per square foot. They now charge, I believe, 80 cents per square foot, just because they are in a position to do so from the fact that it is a patented article.

Mr. A. S. Markley.—Is it possible with this door to have it stop before it goes clear up? If so, then an engine might knock it down, provided it did not clear.

Mr. Brown.—For freight houses we fix the doors so that they can be raised any height desired, so as to protect the men and houses from storms when doors are open, and we also fix them so that they go all the way up and there is an automatic catch to prevent them from coming down and injuring the men. The vertical doors on the New York Central at the 34th Street yard were put in with counterbalanced weights and injured several men.

Mr. Cummin.—I fully agree with Mr. Brown in regard to the Cross Horizontal Folding Door. About two years ago we commenced to use these doors for the first time, and from the day they were installed up to the present time we have never had a request to repair them or do anything to them.

Mr. Shane.—I have quite recently had occasion to go thoroughly into the question of roundhouse doors, and I have found that the principal obstacle I had to meet was the original cost. I found doors covered by patents that I liked and would have preferred to any door that I could get hold of if it were not for that one thing. That is something that we are going to have to contend with. The gentlemen who have patents take advantage and put their prices so high that we cannot afford to patronize them. In considering data and making estimates for our doors I found that I could build a door similar to others that we have had in service for 20 years and maintained at very little expense, at 25 per cent. of the original cost of patented doors. Hence we have to manufacture our own doors.

Mr. A. S. Markley.—There is no doubt that there is serious objection to the swinging door. We have them and there are certain objections in connection with their use which are certainly overcome by the vertical door. The wind closes a door when an engine is coming in and the engine strikes the door and the column is knocked down, as well as a section of roof. It costs from $200 to $300 to replace it. What Mr. Shane says about patents is true. The price of a patented article is so high that railroad companies will not pay it. When the patentees come within a reasonable price there is no doubt but that the folding door is the proper thing for roundhouses. The breaking of doors is very expensive.

Mr. Rettinghouse.—The subject of engine house doors was discussed by the local association on the C. & N. W. Ry. in several of their meetings last year. It was a subject

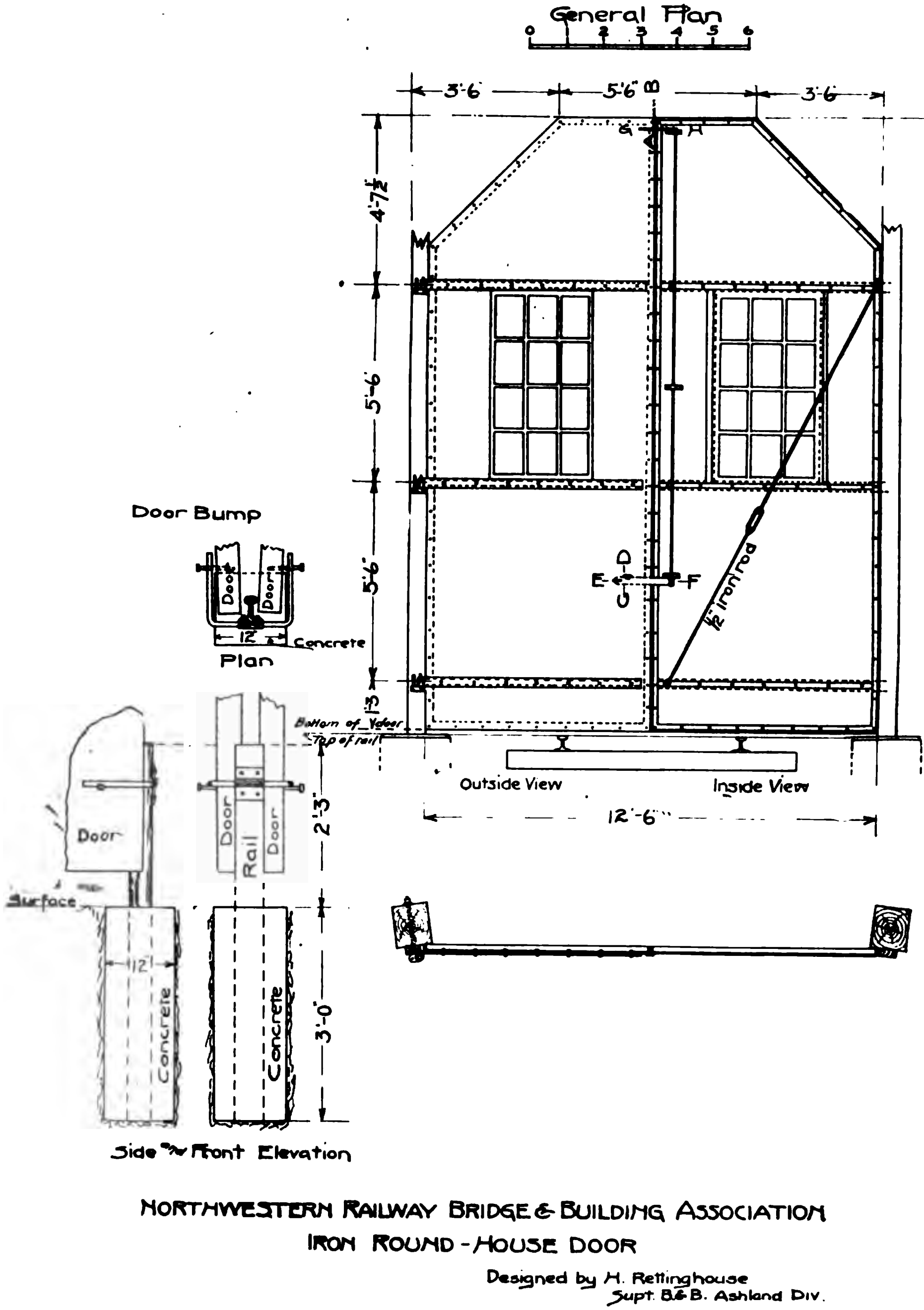


FIG. 39.—Northwestern Railway Bridge and Building Association Iron Roundhouse Door.

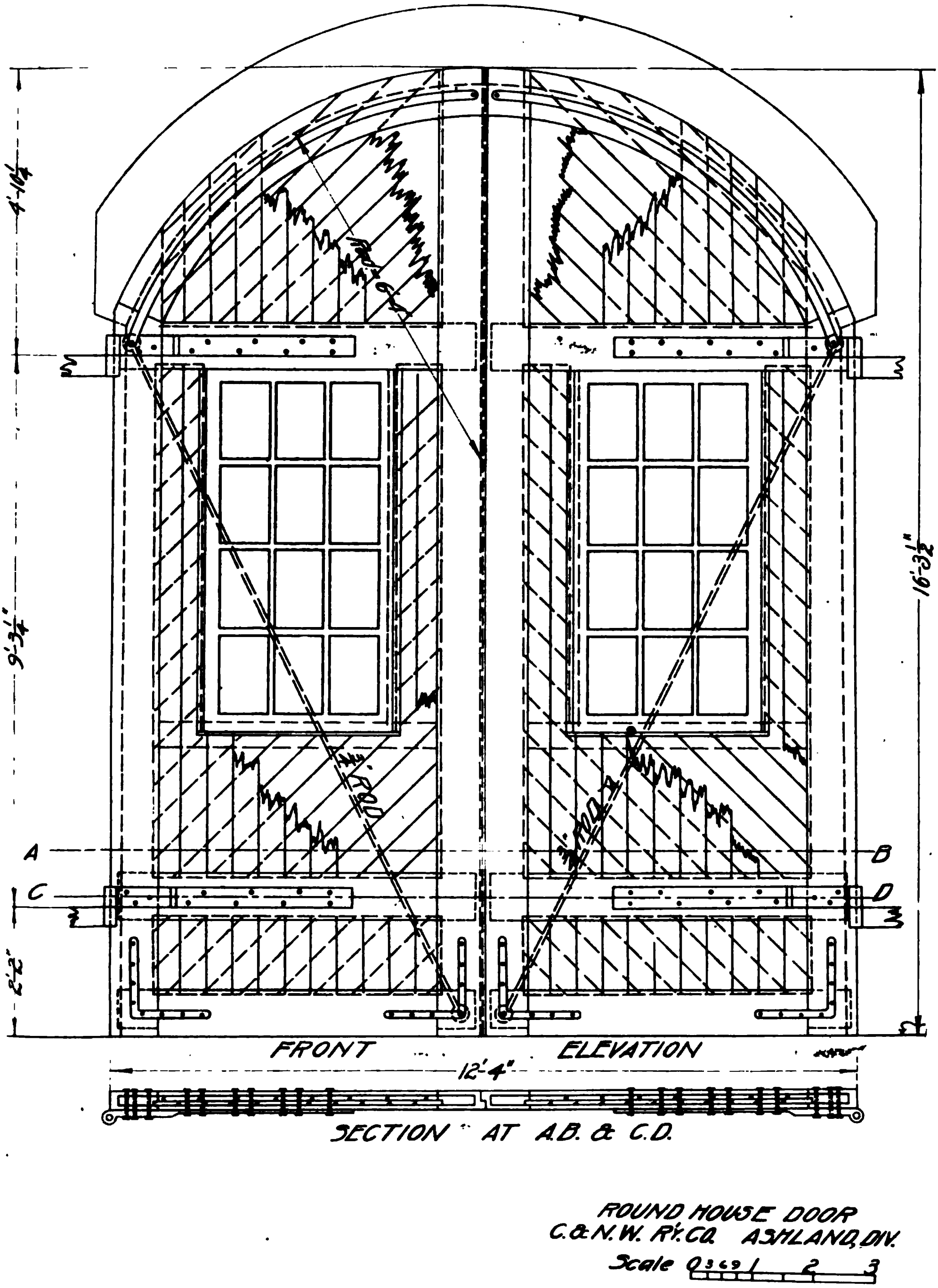


FIG. 40.—Roundhouse Door, C. & N. W. Ry. Co., Ashland Div.

chosen for a report on the committee of which I had the honor of being chairman. It may be of interest to repeat the report that we made at the time. We did not consider the question of folding doors, but simply a set of swinging doors with the idea of substituting or finding something regarding the material and manner of construction which would be better than the present form. The most prevailing form of engine house doors is one nailed together of several thicknesses of lumber (two or more) and it follows very soon that the doors would come to pieces. So we had in mind a swinging door made out of iron, the skeleton being made of light angle iron and filled out with heavy sheet iron. In addition to this I want to say on the subject of doors that we have on our division recently installed new doors on one of our roundhouses and, after giving the matter considerable study, came to the conclusion that the doors should be constructed out of frame work of 4 x 10-inch plank mortised and tennoned together the same as an ordinary door. This will overcome the warping. We have also placed a locking arrangement on the door which will hold the doors in place in good shape. I have a couple of blue prints descriptive of this arrangement, also of the locking device, and, if convenient, I would like to have this made a part of the report.

Mr. A. S. Markley.—I would like to ask whether this was a round or square head door?

Mr. Rettinghouse.—It was a round door.

Mr. A. S. Markley.—We had a number of that kind, but discarded them and put in the square door.

Mr. Rettinghouse.—The hinge is four feet below the top on my door.

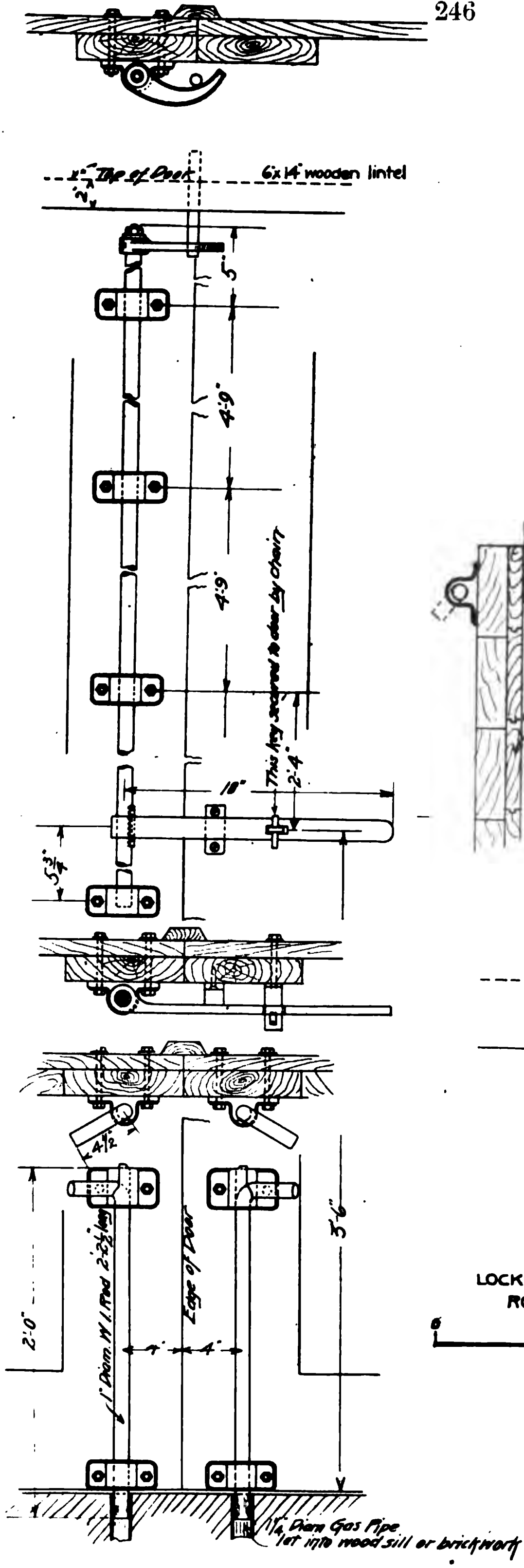
Mr. J. H. Cummin.—One point has been brought out that ought to be interesting to every one in the Association and that is in regard to the wind of the door. I understand we have one member present who has gotten up an attachment for iron doors, so that if they are six inches out of wind they will fit together.

Mr. G. W. Andrews.—The device that he refers to is one very similar to that described in the blue print submitted by Mr. Rettinghouse. Unfortunately I failed to bring a print with me, but I can send it in to the secretary. I want to say in this connection that any one who has had anything to do with building a large door of any kind knows that it is almost impossible to build one entirely true. When you hang it, it is almost invariably out of wind three or four inches and, when you have a door in that condition, it is almost impossible to fasten it with the ordinary fastenings. This design was not original with me. It consists of a rod which runs up to the top of the door with a hook on top and a pin in door head and a movement of the rod brings the hook in contact with the pin, which draws the door up tight. The door may be in wind and the hook will draw it tight. When you have it on you have a fastening which costs probably twice as much as the ordinary fastening, but it lasts as long as the door. In one roundhouse, where the engineer in charge thought to condemn 23 doors simply because they were in wind, these fastenings were applied and saved the doors. It is impossible for a contractor to build a door of this size that will not be in wind. I have made doors of that character and I know how almost impossible it is to build a door without being in wind. I will furnish a drawing of this fastening. I will also say that it is applicable not only to roundhouse doors but to any large doors.

Mr. A. S. Markley.—The arrangement Mr. Andrews refers to we have in use, and they are certainly the best fastening that can be made. They hold a door and make it come up tight and true at top and bottom.

Mr. G. W. Andrews.—I thought I would meet some one who had used this.

Mr. Killam.—We had the round doors but abandoned them and have adopted the square door. We have also abandoned the window in the door and have put a window in the top over the door and, instead of one pair of hinges



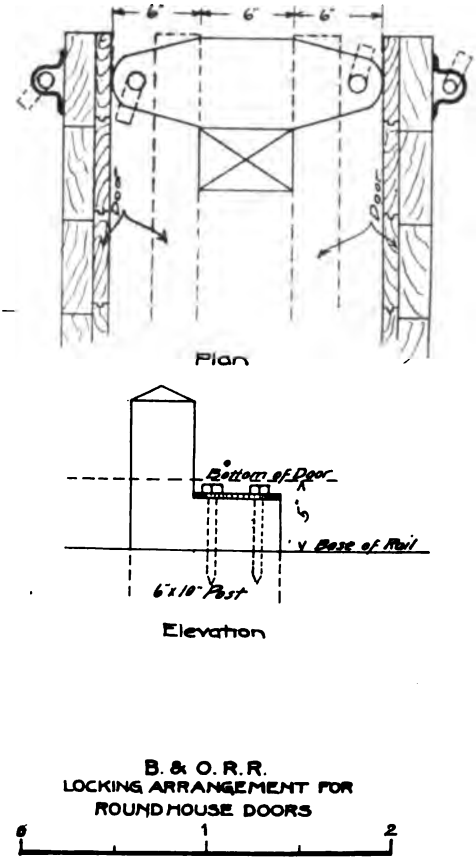


Fig. 41.—Details of Locking Arrangement for Engine House Doors, B. & O. R. R.

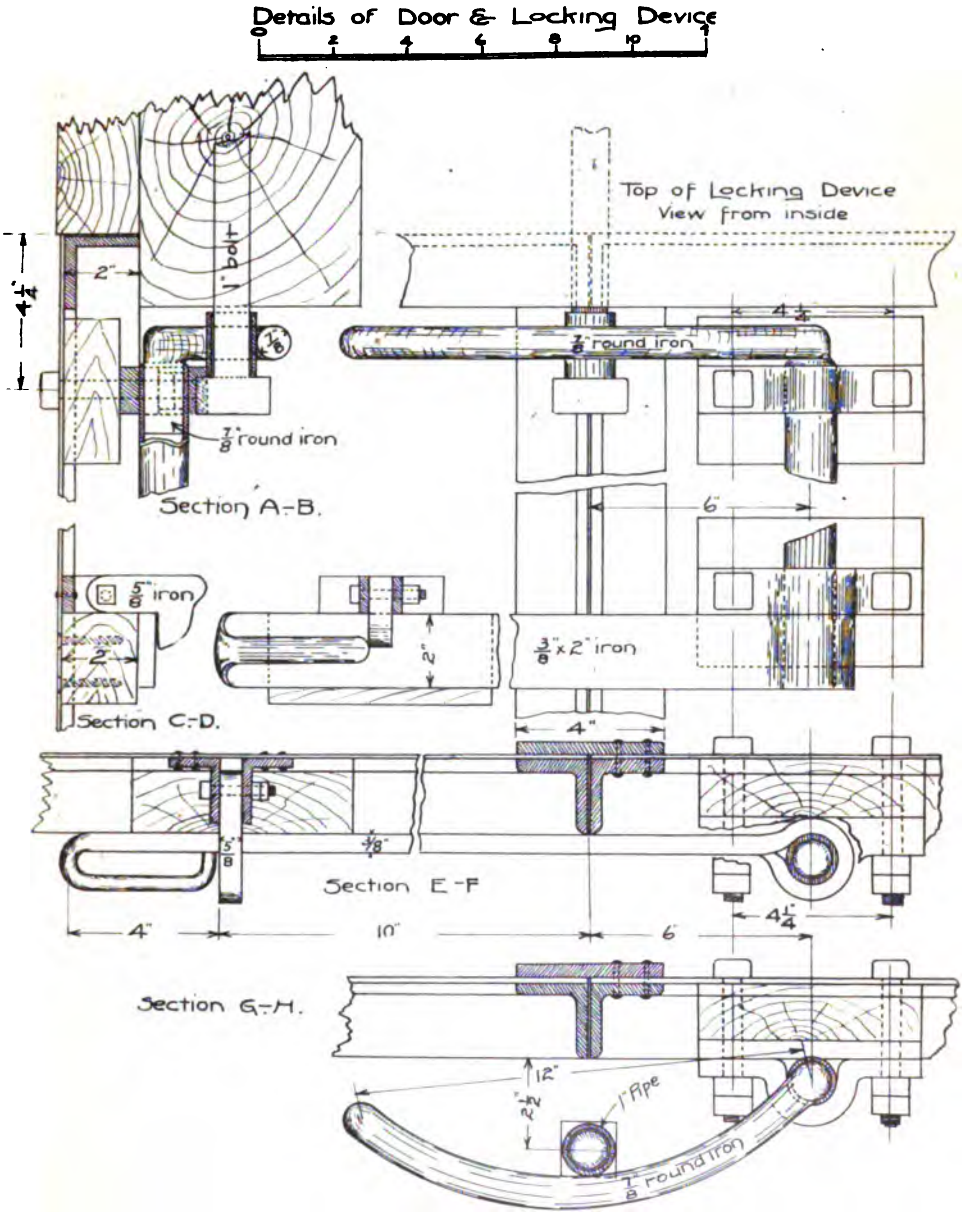


Fig. 42.—Details of Locking Arrangements for Engine House Doors, B. & O. R. R.

on each side, we have put on three hinges and have never had any trouble in keeping our doors tight if properly cared for. They are made solid, of true grained lumber, so that they do not warp and twist. They mostly swing inwardly. Usually there is a small door for entrance on one side. The round top doors were breaking off on top and we had to abandon them. We have endeavored to get the very best door regardless of what it costs. For our freight houses we use a horizontal sliding door which cannot jump the track, and rolls in behind a protection screen, so that it cannot be broken. We have one or two vertical lift doors in the larger freight houses, which work well. There is a great deal of care taken and we seldom have an engine run into them. The counterbalances are made so that the door works very easily.

Mr. Alexander.—We have had some trouble with round-house doors. In one case we made doors of sheathing on a frame and when the engine house was filled with engines and it became very warm, we found that a good deal of ice accumulated and the doors warped and would not remain true. We overcame this by putting a plank above the doors so that they shut under it pretty well and then the inside door closing up against there would make it comparatively tight. An ordinary engine house with four or five stalls does not give us any trouble, but an engine house with 15 or 16 engines gets so warm that a great deal of ice forms. The snow on the roof melts and runs down and forms ice. The form of fastening spoken of here I think will overcome our trouble to a great extent.

Mr. Penwell.—We formerly used for freight houses wooden doors on rollers, but this did not seem to be satisfactory. We have adopted heavy wooden doors, hung on weights, and they work very nicely. The only objection to this is that we have had the rope break a couple of times and it is dangerous. I have recommended an iron door in two cases, but on account of the cost the wooden doors were

installed. Some of the patent iron doors are certainly good but seldom well taken care of. The worst trouble I have is to construct something light enough, as the doors are frequently knocked down. As fast as they knock down an archway we make it square and put on three hinges to the door, and have better success in that way. What I would like to get is a door that is not liable to be knocked down. My experience with roundhouse employees is that they will not take care of the doors. You can provide any sort of a catch to hold the door open, but they will not fasten it. If you can get a door that will go to place and stay there without any danger of being struck by engines, you have gained an important point, and even if we have to pay $50 or $60 for such a door, it would be economy to build it.

Mr. Steffens.—There is on the market a ball-bearing hanger, known as the "Reliance," which is remarkably easily operated. A representative of the concern manufacturing it is present at this Convention.

Mr. McGonagle.—We formerly had difficulty in opening or closing the doors if snow or ice had accumulated around them. By stopping the door about 10 inches above the top of the rail and taking a solid piece of timber and grooving it over the rail and moving it along whenever we found it necessary to open the doors, we have overcome this difficulty. This may be of some interest to some of the members.

Mr. Sheldon.—Was that outside or inside of the door?

Mr. McGonagle.—It was directly under the door and a piece of 2 x 4 could be spiked to the top to form a rabbit.

Mr. Reid.—I would suggest an improvement on Mr. McGonagle's suggestion. Put in a short door as suggested, but, in place of putting in an independent piece of timber, fasten it to the door on hinges to be raised up when the door is opened.

Mr. Alexander.—I might say in regard to doors swinging outward that we had doors in engine houses of that de-

scription and we had to change them so that they would swing inward, as in a heavy wind we found it impossible to have them swing outward and keep them in place. With the doors that we built the opening was not so wide when swinging out as when swinging in. We put on an automatic catch and have never had any trouble in holding them open. A small chain hangs from the hook, which unlocks the catch when desired. This is a very good device and we have no trouble where we use it.

Mr. Brown.—I am afraid that there are very few of our roads which would care to afford the expense of the additional width of house necessary to have the doors swinging inward.

Mr. Shane.—I have just completed plans for a roundhouse and paid considerable attention to the doors, knowing from past experience that they made us a great deal of trouble, so I have designed my doors in this instance to open inwardly, to protect them from wind storms and at the same time afford better and more secure fastenings to hold them in position while they are open. We can also in this way hold a door more firmly and prevent its warping if it stands open very long. I have designed a square top door because I believe that will not warp so badly.

Mr. J. P. Snow (written discussion).—*Freight House Doors.*—On the track side of freight houses it is convenient to have either an outside platform or to have the side of the house all doors. Where land is valuable it is not economical to have a platform which cannot be closed in and used for storage. This means that the side of the house must be close to the car and if it is not all doors there is trouble and expense from spotting cars opposite the doors. Again, if there are posts between the doors, an occasional one is bound to come right in front of a car door. To accommodate these conditions the Boston & Maine road is building terminal houses of wood, with the side posts set six to eight feet in from the side of the building and overhang-

ing the roof trusses to carry the side wall and doors. The doors are hung on two parallel tracks, so that they can run by each other and, if desired, can be run apart so as to open up a large section of house. They are held at the bottom by a bar-iron guide set well below the floor level to form a weather shield. This idea was absorbed from a description given by our member, Mr. A. S. Markley, before the American Railway Engineering and Maintenance of Way Association. Our freight officials are very much pleased with them.

On the wagon side the doors may be hung on the inside as described in the report and far enough apart so as not to interfere with each other.

At water terminals, where freight sheds must accommodate vessels, teams and cars, the door problem may be complicated.

On the water side the doors must be high, at least 16 feet, and 20 feet is better. They must be continuous but posts are not so objectionable as in the case of cars. It is best to hang the doors outside the posts, but there must always be a fender platform outside them, although perhaps not over two feet wide. This allows a different treatment at bottom of door than the guide described above, and the posts furnish ready means of fastening when closed.

Doors for admitting teams to sheds like these sometimes require special treatment. They must be large, say 14 feet high and 16 feet wide. It may be inconvenient to have them slide or swing and there may be no height overhead to dispose of them vertically. Roller shutters are expensive and liable to injury from bruises. An inexpensive and fairly convenient method of opening a door under these conditions is to hinge the door strongly at top, slide the lower half by counterweights up on the inside of the upper half and hitch a fall by a crotch hitch to the lower corners of the upper half and haul it up to a horizontal position. If we haul up the whole door without sliding

up the lower half it is too heavy for safety and for wheeling freight in or out on barrows it is oftentimes only necessary to run up the lower half.

Slide door hangers should be of such pattern that they cannot leave the track without being disconnected from the door. Any hanger that can be lifted off will certainly be dislodged by the wind. I do not agree with the report in thinking that vertical and side adjustment is very essential. Neither is an anti-friction device indispensable. Essential features are simplicity, strength and impossibility of getting off the track. The other features are secondary.

Roundhouse doors should swing into the house. An automatic catch is a good thing to provide for holding them open, as the men are very careless about fastening them open and, if left free, they are very likely to swing into the way of an engine when it is moving out. I do not agree with the report as to using a swing bar for holding these doors closed. There can be no stop at the bottom for them to shut against and I think there should be a substantial bar to drop into a socket in the sill timber, and another to enter a socket in the lintel to hold one door; the other may be hasped to it. These top and bottom bolts should be operated independently, as the door cannot be brought exactly right at top and bottom for entering both bolts at once.

We often see roundhouse doors hung so that they occupy with the post as much as 18 inches when open. This is room wasted. The distance between centers of tracks at the doors determines the floor space occupied by one engine. We give 11 feet clear width and get our doors and posts into 10 inches, hence, if 18 inches is used the building must be some five and one half per cent. larger than ours to cover the same number of engines. We use posts made of Z bars and hang the doors by three hinges on angle iron lugs.

XI.—Best Methods for Preserving Timber and Piles in Structures.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

The subject of preservation of timber has been so largely discussed in connection with the tie question that in writing of preservative processes as applied to wood from the standpoint of the structural engineer your committee has not hoped to do any original work, but has tried to select from the numerous existing works on the subject those salient features which will present to the members of this Association who have little time for individual research an outline of the main principles underlying the various processes.

The necessity for using preservative processes at all will depend upon various conditions,—principal of which are:

(1) First cost of lumber.

(2) Kind of structure in which it is to be used.

(3) Cost and ease of rebuilding structure when original materials have changed their nature by decay or wear, so as to be no longer suitable for the use for which originally intended.

To illustrate:—If a building is to be erected, which, due to conditions, will be removed in a number of years less than the life of untreated timber, it would plainly be uneconomical,—in fact, folly,—to employ treated timber. If, on the other hand, a permanent structure is to be built, especially of the variety to rebuild which would cause considerable disturbance to traffic, in addition to the labor cost involved, the economy of using timber treated by one of the many processes is then evident.

In view of the fast failing source of timber supply, the use of timber treated with the object of preserving its life will become more necessary every year. It is hardly to be expected, however, that the railroads, who are the largest users of timber in the country, will view the matter from the standpoint of a national necessity so long as the price of lumber remains at present prices, as will be stated more in detail later. Of the miles of timber trestle on the various large railroad systems in this country but a relatively few structures are built of preserved timber. One member has well stated that preservative processes undoubtedly have not been used more generally on account of the uncertainty and ignorance concerning them.

In order to approach intelligently this subject, a knowledge of the structure of wood in general, and conditions favoring decay of same, will be of value.

Wood is composed of a series of tubes, the chemical compo-

sition of which in general is cellulose,—these tubes being united in a direction parallel with the axis of the tree. When these cells are first formed they are filled with what is known as protoplasm, which deposits on the walls of the cells, thickening them, until the matured wood cells are formed. The size and distribution of these cells varies for the different kinds of wood. As the tree grows new cells are added next to the bark. The cells nearer the center of the tree gradually lose their original contents of protoplasm, and become filled with gums and resins.

The decay of timber is caused principally by fungi, but also by bacteria and insects. The fungi are a low order of plants composed of thread-like structure called hyphæ, which collectively form the mycelium. The mycelium has its origin from a spore or microscopic seed, which germinates, and sends out a single thread, or hypha, which soon branches and multiplies, filling the cells of the wood. For sustenance they depend upon the starches, sugars, and oils contained in the cells. In the process of obtaining their food the chemical compounds of the wood are changed, and there is left behind the substance known as rotted wood. The fruit of the fungi are best known in the form of toadstools or mushrooms, that are found on timber in the forests.

The three conditions necessary for the growth of mycelium—in other words, decay of timber—are air, moisture, warmth. Without one of these decay is impossible. Timber submerged in water may be destroyed by marine animals, but will never decay. Timber exposed to a constant low temperature, or kept perfectly dry, will never decay.

Note.—A full description and reproductions of photographs relative to this matter may be found in Bulletin No. 14, by Hermann Von Schrenk, United States Department of Agriculture.

With the above general properties of wood understood, it will now be in order to give

An Outline of Preservative Processes.

These are:

(a) Creosoting, or treatment with dead oil of coal tar, often called the Bethell Process.

(b) Burnettizing. (Chloride of Zinc.)

(c) Kyanizing. (Bi-chloride of Mercury.)

(d) Wellhouse. (Chloride of Zinc, with Glue and Tannin.)

(e) Allardyce. (Chloride of Zinc with Dead Oil of Coal Tar.)

(f) Boucherizing, or Margaryizing. (Sulphate of Copper used, but name applied primarily to method.)

(g) Thilmany. (Copper Sulphate and Zinc Sulphate, with after treatment of Barium Chloride.)

(h) Hasselmann. (Sulphate of Copper, Iron, and Aluminum.)

(i) Creo-resinate. (Creosote, Resin, Formaldehyde, followed by milk of lime.)

(j) Hagen Method. (Chloride of Zinc and Gypsum.)

(k) Woodiline and Carbolineum Avenarius.

(l) Vulcanizing.

Within the limits of this paper it will not be possible to give full details for the above processes. Their general characteristics are as follows:

(a) *Creosoting.*

The dead oil of coal tar used in this process is a product of the distillation of coal tar, a by-product from the manufacture of illuminating gas. It contains a considerable amount of carbolic acid. The chemical compounds contained, which have an important bearing upon its preservative properties, are given in table below:

[Table No. 8.]

NAME.	Symbol.	Fuses.	Vaporizes.
HYDROCARBON COMPOUNDS, ACIDS.			
Napthalene	$C_{10}H_8$	79°	218°
Napthalene, Di-hyd	$C_{10}H_{10}$	Liquid.	200°
Napthalene, a, Methyl	$C_{11}H_{10}$	"	242°
Napthalene, b, Methyl	$C_{11}H_{10}$	32.5°	242°
Napthalene, Di-Methyl	$C_{11}H_{12}$	Liquid.	262°
Napthalene, Tetrahyd	$C_{10}H_{12}$	"	190°
Anthracene, Di-hyd	$C_{14}H_{12}$	106°	305°
Anthracene, Hexahyd	$C_{14}H_{16}$	63°	290°
Phenanthrene	$C_{14}H_{10}$	100°	340°
Fluoranthrene	$C_{15}H_{10}$	109°	360°
Retene	$C_{18}H_{18}$	99°	350°
NITROGENIZED COMPOUNDS, BASES.			
Pyridine	C_5H_5N	Liquid.	116.7°
Picoline	C_6H_7N	"	135°
Lutidine	C_7H_9N	"	152°
Collidine	$C_8H_{11}N$	"	170°
Coridine	$C_{10}H_{15}N$	"	211°
Rubidine	$C_{11}H_{17}N$	"	230°
Viridine	$C_{12}H_{19}N$	"	251°
QUINOLINE SERIES.			
Leucoline	C_9H_7N	Liquid.	240°
Isquinoline	C_9H_7N	18°	236°
Quinaldine	$C_{10}H_9N$	Liquid.	243°
Indoline	$C_{10}H_9N$	"	252°
Oryptidine	$C_{11}H_{11}N$	"	274°
Acridine	$C_{13}H_9N$	111°	360°

Of the above the napthalene compounds, which are the most abundant, are of great value as antiseptics. Napthalene proper melts at 79° C., and vaporizes at 212 to 220° C. Its specific gravity at boiling point is 0.9778. It is insoluble in cold water, and but slightly soluble in hot water, and for average temperature may be termed non-volatile. Dead oil weighs about 8.8 pounds per gallon. When used as a preservative it undoubtedly coats the cells of the wood fibre. If sufficient quantity is used it undoubtedly entirely fills the pores of the wood, providing the sap has been removed. This condition of filling the pores of the wood cells is valuable in any preservative process where insoluble material is used, inasmuch as water, one of the agents necessary to decay, is thus excluded.

Preservative processes in general consist of three stages: Seasoning, removal of sap and moisture, application of the preservative to all of the wood cells. Seasoning may be accomplished artificially. At the present time, however, when orders for lumber must of necessity be filled direct from the forest, a process of steaming is almost entirely used. In steaming the fresh timber is placed in a closed cylinder, to which live steam is admitted and held under pressure for several hours. This results in liquefying the sap and solidifying the albumen. The water contained in the wood cells is transformed into steam, and is driven off. The temperature of the steam depends upon the pressure, and should not vary more than between the limits of 200 to 250° F. After the steaming has continued for a proper length of time the air contained in the cylinder is exhausted, and a partial vacuum maintained for a short interval of time, during which the moisture and liquids formed by the steam are expelled from the interior of the timber. The cylinder is then filled with the dead oil at a temperature of about 175° F., the pressure in the tank being raised to 80 to 100 pounds per square inch, and maintained until the pores of the wood have absorbed the necessary amount of oil.

The method of procedure is essentially the same for the various processes of creosoting, with the exception of that known as the Rueping process, in which the oil is driven into the wood by pressure after the cells have been previously filled with air under high pressure. When the air pressure is removed the cells are partially emptied of their oil contents. In brief, the fiber of the wood cells is merely coated with the preservative.

(b) *Burnettizing.*

In this process the impregnating fluid is zinc chloride, which is applied in the form of a solution in water, similar to method for creosoting. After treatment the wood must be thoroughly dried, in order that the salt contained in the solution may be deposited in the fiber of the wood. If the wood is afterward exposed to the action of water, the salt is leached out, leaving the cells unprotected eventually. To overcome this possibility

a concentrated solution has been proposed, but this is impracticable, as injurious to the fiber of the wood, rendering it brittle. The process has been extensively used in tie preservation, but from the two properties above mentioned is not desirable for the treatment of structural timber. It will be of interest to state that this process has been abandoned by nearly all the European railroads.

(c) *Kyanizing.*

In this process the seasoned timber is steeped or soaked in a solution of bi-chloride of mercury (better known as corrosive sublimate, the strongest antiseptic of metallic salts). This solution coagulates albumen, is very poisonous, and attacks iron, hence is unsuited for structural purposes where iron is used to fasten the members of a structure together. On account of its corrosive properties, tanks containing it must be constructed of stone, wood, or other substance not affected by it. Instances can be cited where structures built of Kyanized timber have existed from twenty-five to thirty-five years without decay.

(d) *Wellhouse.*

In this process zinc chloride is used, to which has been added a small percentage of glue. After the timber has been treated under pressure, the solution is drawn off and a solution of tannin added. The latter combines with the glue to form a plug, of a leathery, water-proof substance, thus excluding damp and retaining the salt.

(e) *Allardyce.*

In this process the timber is first treated with an injection of a solution of zinc chloride. This is followed with a second injection of dead oil, for the purpose of closing the pores of the wood and preventing the escape of the zinc salts.

(f) *Boucherizing, or Margaryizing.*

In this process the antiseptic solution was applied under hydrostatic pressure to the end of the timber to be treated, so that the solution should be forced through the pores of the wood. The salt mainly used was sulphate of copper, so that the name has of late been applied to the use of that chemical rather than as originally to the method of injecting it. This process is objectionable from a structural standpoint, as the salt attacks iron brought in contact with it, due to the sulphuric acid which is formed.

(g) *Thilmany.*

In this process the timber was first impregnated with a solution of sulphate of copper, and then with a solution of barium

chloride. It was supposed that a chemical combination would be formed, depositing sulphate of barium and copper chloride in the pores of the wood. Results of this process have been unsatisfactory.

(h) *Hasselmann.*

In this method timber is boiled in a solution of copper, iron, and aluminum sulphate, to which a small amount of kainit is added. The latter is a salt consisting of potassium and magnesium sulphates and magnesium chloride. It is supposed that the boiling produces a chemical reaction between the fiber of the wood and the salts used. Statistics relative to this process are not abundant. Where used in Germany it seems to promise good results.

(i) *Creo-Resinate.*

In this process the timber is first subjected to a temperature of 200° F, with the object of evaporating moisture contained in the cells. The temperature is increased gradually to about 300° F., and the pressure increased to 80 pounds per square inch. The temperature and pressure are then both gradually reduced. At a temperature of about 200° F., and a vacuum of 26 inches, a solution of dead oil, melted resin, and formaldehyde is injected. The timber is then placed in another cylinder, and solution of milk of lime applied, at a temperature of about 150° F., and a pressure of 200 pounds per square inch. The efficacy of this process is undoubtedly largely due to the preliminary heating of the timber. Statistics relative to this process are as yet meagre.

(j) *Hagen Method.*

In this process a solution of chloride of zinc and gypsum is used. The efficiency of the gypsum in sealing the pores of the wood when it has crystallized is doubtful.

(k) *Woodiline and Carbolineum Avenarius.*

These substances contain creosote as the main ingredient. They are applied by brushing or soaking the timber with the material. In many cases the use of these substances may be warranted as hindering the decay of timber. They cannot replace the more thorough methods of impregnation and sterilization. The specifications of one important railroad require that when two wood surfaces are joined they shall be treated with a material of this variety.

(l) *Vulcanizing.*

This process consists in subjecting timber to the action of air, which has been heated to a temperature of 500° F. The air is heated by passing it over coils, through which live steam is

circulated. It is supposed that the heat coagulates the albumen, expels the water from the wood cells, kills the organisms which may exist therein, and seals the cells by transforming the sap into preservative compounds, which are prevented from escaping by the pressure at which the heated air is supplied. This method has been used by the elevated railway systems of several cities, with good results. The cost of this process is about the same as for creosoting, and as it possesses only in part the many excellent features of the latter process, creosoting is to be recommended in preference to vulcanizing.

RECOMMENDATIONS.

To sum up: Mr. Hermann Von Schrenk* has well expressed the conditions to which the ideal preservative should conform:

(1) It must be poisonous to bacterial and other destroying agents.

(2) It must be capable of easy injection, and when once in the wood it ought to stay there.

(3) It must penetrate all parts of a piece of timber.

(4) It must be cheap.

The above qualifications immediately exclude from the list of ideal preservatives those processes which employ salts soluble in water, and fix one's attention on the creosoting method, which is without doubt the most universal and best method to date. The dead oil is antiseptic, thus preventing the formation of hyphæ. It is insoluble. It fills the wood cells, thus excluding all moisture. Timber treated by it is proof against the attacks of limnorea, and the teredo. The argument against it, that is, first cost, is largely offset by its many other good qualities, and the extremely long life of timber treated by it. As the use of this method of preservation becomes more extended the cost of same will be greatly reduced, undoubtedly to a point at which timber treated by it will become available for purposes where higher cost now makes it prohibitive. For ordinary purposes for which timber is used it is recommended that an average amount of creosote of 12 pounds per cubic foot of timber treated be used (for piles and submerged work this quantity should be increased; in water in which the teredo abounds 22 pounds per cubic foot of timber treated should be used), that for the steaming process a temperature not varying more than between the limits of 200 to 250° F., and for the amount of steaming necessary that one hour for each inch of minimum depth of stick be used. Lower temperature than 200° will not produce the necessary effect in the interior of the wood cells. Greater temperature than 250° would be injurious to the wood fiber.

*Bulletin No. 14, U. S. Department of Agriculture.

It is also the opinion of this committee that too much stress cannot be laid upon the matter of proper seasoning of the timber before treatment. The best argument in favor of seasoning is the result obtained in European countries, where timber is cut from six months to one year before it is used.

Attention is called to the specifications for this process, given in Appendix to this report.

W. F. Steffens,
C. C. Witt,
Committee.

APPENDIX A.

Specifications for Creosoting Southern Yellow Pine with Dead Oil of Coal Tar, Creosote,

As used by the *United States Government* and the *Bell Telephone Companies* for all their work.

Treatment.

The wood shall be impregnated with genuine dead oil of coal tar (creosote) in accordance with the following directions:

Steaming Process.

The lumber shall be first subjected to treatment with live steam in a closed cylinder. The duration of this treatment shall be from three to six hours, according to the condition of the wood. The temperature during this process shall not be less than 200 nor more than 275° F.

Exhausting Process.

As soon as the steaming process has been completed the steam shall be blown off and a vacuum pump shall immediately be applied to the creosoting cylinder. This process of pumping shall be continued as long as it is necessary to remove all the sap and water from the wood, and until at least twenty inches of vacuum is obtained.

Saturation Process.

Immediately after the exhaustion process, and before the vacuum pump has been stopped, the cylinder shall be filled with oil. The oil shall have a temperature between 125 and 250° F. when applied. Pressure shall then be applied until 12 pounds of oil have been forced into the wood.

Dead Oil of Coal ar.

The following requirements for the oil used in the above treatment must be fulfilled:

(1) The oil must have a specific gravity of at least 1.01 at 33° C.

(2) The oil shall be liquid at 38° C.

(3) The oil shall contain at least 40 per cent. of napthalene.

(4) The oil shall not contain more than 4 per cent. of water.

(5) At least 20 per cent. of the oil shall not distil below 270° C.

Inspection.

The lumber, before and after treatment, the oil and the treating process, may be inspected by the purchaser or his representative.

Note.—The above through courtesy of the Wyckoff Pipe and Creosoting Company of Stamford, Conn.

COPY OF SPECIFICATIONS FOR CREOSOTING TIMBER AS RECOMMENDED BY THE NORFOLK CREOSOTING COMPANY, NORFOLK, VA.

Materials.

Timber shall be of the dimensions specified, straight, free from windshakes, large or loose or decayed knots, redheart, or anything impairing its strength or durability, and to be cut from sound live trees, and to be . .

Oil.

All oil shall be the heavy or dead oil of coal tar, containing not more than 1½ per cent. of water, and not more than 5 per cent. of tar, and not more than 5 per cent. of carbolic acid. It must not flash below 185° F., nor burn below 200° F., and it must be fluid at 118° F. It must begin to distil at 320° F., and must yield between that temperature and 410° F. of all substances, less than 20 per cent. by volume. Between 410 and 470° F. the yield of napthalene must be not less than 40 nor more than 60 per cent. by volume. At two degrees above its liquifying point it must have a specific gravity of maximum 1.05 and minimum 1.015.

PROCESSES OF TREATMENT.

Seasoning.

This is to be accomplished by subjecting the timber to the action of live steam for a period of from five to seven hours at a pressure of 35 to 55 pounds per square inch, the temperature not at any time exceeding 270° F., unless the timber be watersoaked, in which case it may reach 285° F. for the first half of the period. At the expiration of the steaming the chamber shall be entirely emptied of sap and water by drawing off at the bottom. As soon as the chamber is cleared of all sap and water a vacuum of not less than 20 inches shall be set up and maintained

in the chamber, for a period of from five to eight hours, or until the discharge from the vacuum pump has no odor or taste, the temperature in the chamber being maintained at between 100 and 130° F. The chamber being again emptied of all sap and water the oil is to be admitted, the vacuum pump being worked at its full speed until the chamber is filled with oil. As soon thereafter as is practicable, such a pressure shall be set up as shall cause the entire charge of timber to absorb . . pounds of oil within . . per cent., more or less (at a minimum penetration of 1½ inches in round timber for a treatment of 12 pounds of oil per cubic feet, constituting a basis for determining the penetration due to a treatment of any specific quantity of oil) . . . inches from all exposed surfaces. The depth of the penetration being ascertained by boring the treated piece with an auger, making a hole not more than ¼ inch in diameter, such pieces as are found not to have the required penetration being returned to the chamber with a subsequent charge for further treatment.

Inspection.

Inspection shall be made as the work progresses, and at as early a date as is practicable, in order that there may be a minimum loss of time and materials due to rejections. The inspector, or other authorized agent of the purchaser, shall have reasonable notice of the intention on the part of the contractor to begin the treatment of a charge of timber, and he shall have at all times during the treatment of the timber under his charge access to the works, and all reasonable and necessary facilities for ascertaining that all of the requirements of this specification are complied with; such "reasonable facilities" providing opportunity, at the proper time, for measuring all timber, treatment-chambers, oil-tanks, etc., and for taking samples of the oil being used, for analysis, as often as he may deem necessary.

Note.—All cut ends, mortises, tenons, and other incisions of the original surface of creosoted timber, shall be protected by not less than four coats of creosote oil, applied boiling hot with a brush or mop. In the case of mooring piles, fender piles, and other timber having the cut end exposed to the weather, the portions so exposed should have, in addition to the creosote oil, a heavy final coat of a paste made of equal parts of unslaked lime and creosote oil, applied hot.

APPENDIX B.

Statistical.

Circulars were sent out to the leading roads in the United States, Canada, and Mexico, requesting data of timber structures now existing.

Replies received from over 50 per cent. of these inquiries show that less than two per cent. of the railroads of North

America have used treated timber. Of these the largest user is the Louisville & Nashville Railway. Through the courtesy of Mr. R. Montfort, chief engineer, the following data were furnished:

On the New Orleans & Mobile Division there are 25 pile trestles, all of creosoted material, length 21,480 lineal feet, and iron and steel bridges, 7 in number, 5,965 lineal feet, supported on cresoted piles. The former were constructed in 1878; the piers supporting the latter in 1876.

On the Pensacola & Atlantic Division there are 62 pile trestles, total length 30,293 lineal feet. Three of these trestles, aggregate length 12,468 lineal feet, are creosoted. The other structures on this division are three combination bridges, 405 lineal feet total length, and four iron bridges, 672 lineal feet total length, supported on creosoted piles driven in 1882. The piles and timber in these trestles were treated by the usual creosoting process, and were given as much as 20 pounds of creosote per cubic foot of timber. The piles are still sound, and good for many years to come. Untreated timber in these waters would stand about seven years against decay, and about six months against the attacks of the teredo.

The average number of pile or timber structures on the roads from whom answers were received is about 65 per cent. The structures mentioned range in size from an opening of about 8 feet span timber stringers, to a pile and timber trestle 8,000 feet long.

The time has evidently not yet arrived when beyond patriotic reasons the necessity for use of preservative processes is apparent.

The price of untreated timber ranges from $10 to $14 for cedar, cypress, white oak, and tamarack, to $25 and $28 for yellow-pine, according to locality where purchased.

Several roads, one prominent Eastern railroad included, are using creosoted timber above low water line for pier construction. The use of treated timber will undoubtedly become more prevalent in this form of structure, where the inaccessibility of substructure and inconvenience due to disturbance of traffic, render desirable less frequent renewals.

For convenience in estimating, the following data may be of value:

The weight of one gallon of dead oil is 8.8 pounds. The cost about 7 cents per gallon. Cost of creosoting on large scale about 5 cents per cubic foot of timber treated.

For average conditions 12 pounds of creosote per cubic foot may be used. This is about the maximum that yellow pine will absorb. For piling and submerged work the amount per cubic foot should be increased to a maximum of about 22 pounds per cubic foot, for protection against the teredo.

A rough rule for convenience in estimating will be to use a cost of 1 to 1¼ cents per pound of creosote in place.

APPENDIX C.

Bibliography.

The literature on this subject is fairly voluminous. The works mentioned below, however, have been selected as typical, from which one may obtain considerable information relative to the general principles underlying the subject:

Bulletin No. 9, U. S. Bureau of Forestry, Department of Agriculture. E. E. R. Tratman. "Report on the Use of Metal Railroad Ties, and on Preservative Processes of Metal Tie Plates for Wooden Ties."

Bulletin No. 14, Bureau of Forestry, Department of Agriculture. "The Decay of Timber, and Methods of Preventing It." Hermann Von Schrenk.

"Preservation of Timber," by S. B. Boulton. Excerpt Minutes of Proceedings of the Institution of Civil Engineers, Volume 78, Part 4, London.

Octave Chanute. "The Preservative Treatment of Timber." Journal of Western Society of Engineers, April, 1900, Reprint.

Octave Chanute. "The Preservation of Railway Ties in Europe." Transactions American Society of Civil Engineers, XLV, 1901.

W. W. Curtis. "The Artificial Preservation of Railroad Ties by the Use of Zinc Chloride." Transactions American Society Civil Engineers, XLII, 1899.

Vladimir Herzenstein. "Preservation of Wood." International Railway Congress, Bulletin, Volume 15, No. 10, October, 1901.

F. A. Kummer. "A Proposed Method for the Preservation of Timber." Transactions American Society of Civil Engineers, XLIV, 1900.

American Railway Engineering and Maintenance of Way Association. First Annual Convention, 1900. Second Annual Convention, 1901. "Report of Committee on Ties."

P. H. Dudley. "Decay of Timber." *Railroad Gazette*, March 8th, 1901.

E. E. R. Tratman. "Track and Track Material."

W. M. Camp. "Notes on Track."

Norfolk Creosoting Company, Norfolk, Va. Hand-book giving outline of process.

Atlantic Creosoting & Wood Preserving Works, Norfolk, Va. Hand-book giving outline of process.

See, also, Engineering Index for other works on this subject.

DISCUSSION.

President.—Mr. Steffens is chairman of this committee and has made a report, which I do not think it will be necessary to read. Has any one anything to offer on this subject?

Mr. Steffens.—I have here all the correspondence that has passed on this matter and as there are one or two items which may be of interest I will quote them verbatim.

(Here followed reading of letters, emphasizing various points of the report.)

The point which I wish to bring out is that of the great mileage of timber trestles in this country, but an extremely small proportion of such are built of treated timber and piles. The railroads do not seem to have reached a stage where they have demed it necessary to look into the subject. In the circular which we sent out was included an inquiry as to the extent that treated timber was used in structures other than bridges. In the reply received from the D., L. & W. road the statement was made that in pier-shed work, for the substructure above the low water line creosoted material was used. To one who has experienced the difficulties in making renewals at large terminals where piles have decayed above the water line this point will appeal most strongly. We are replacing in many cases the tops of the piles with 12 x 12 timbers and sawing off the piles when repairing piers. The difficulties attending this work and maintaining traffic are many.

This subject is one to be treated rather from the engineer's standpoint. It has been discussed most extensively in the various engineering publications, in the scientific press, and even by letter, but the aspect of the question, which we considered the central one in the report, has not been taken up extensively heretofore.

In renewing bridges on branch lines, where traffic is light, so that expensive masonry work cannot be afforded, old steel from main line bridges, where it has outgrown its

usefulness, can be supported on pile bents with sheathing behind to hold the bank. The use of treated timber may in this case be well worth investigating.

Mr. A. S. Markley.—In the treating process, is it possible with a pile 40 or 50 feet long to inject the preservative through the entire length of the pile?

Mr. Steffens.—That depends upon the timber treated. In the case of oak the creosoting companies state that it will be impossible to use 12 pounds per cubic foot, but that they will reach that point as far as possible. In the case of yellow pine the timber structure is of cellular form and the tubes very readily receive the impregnating mixture. In the case of oak the cells close with age and the wood becomes very dense and hard. Hence the difficulty noted.

Mr. R. H. Reid.—I think it is a fact that very few, if any, of the creosoting companies will attempt to creosote oak at all. They will creosote nearly everything else, but in treating yellow pine they only get it in about three inches. It goes into it principally from the sides. The center will not be touched as far as the creosote is concerned. In the case of creosoting green timber they cannot do as well as with dry timber. Most of the creosoting companies prefer sap wood, while the sap wood of the yellow pine is what we are trying to avoid. The sap wood of the ordinary yellow pine will hardly last long enough to get it into a structure, and while it may be better when creosoted than to use it untreated, it seems to me that it would be still better to use good timber.

Mr. A. S. Markley.—The Chicago Tie Preserving Company has been treating ties for the C. & E. I. since 1890. Their methods are entirely different from the creosoting process. It is called the zinc-tannin process. They put these ties in their tanks and put on 200 pounds of steam pressure, driving out the sap, which is measured, and they can tell just how many gallons of sap they have taken out. Then they take off the steam and put in the zinc in the same way. After a short time that is taken off and glue is put on in

the same manner, which seals up the cells in the ends of ties, retaining all the chemicals. I have watched this very carefully and all our ties are treated. About two weeks ago one of our section foremen reported that he had taken out one of these ties put in during 1900. On examination I found that it was just as good as when put in except on one side, where sap had been laid to the weather and had crushed under the rail. The balance of timber, where there was no sap, was apparently as good as ever.

Mr. Shane.—I think perhaps that some of the members may not have had their attention called to the fact that the United States Department of Forestry has issued a very interesting circular on the treatment of wood, and frequently issues very interesting papers on the different timbers as to their durability and quality, and if there are any members here who have not yet placed themselves on the mailing list of the United States Department of Forestry, they should do so at once, as they issue some very interesting circulars and it does not cost you a cent.

Mr. Penwell.—I have never gone into this subject myself, it being more of an engineer's business, but one of our branch lines runs through the Indiana oil fields, where the creeks are carrying oil on top of the water. I inspected some bridges this fall where we have piles which were driven in 1891 and these piles seemed to be as good as when driven. They have been in over 13 years and have not commenced to deteriorate. The end bents in these bridges have rotted.

Mr. A. S. Markley.—One part of our road runs through swamp land in northern Indiana at the crossing of the Kankakee River, where we have piles put in during 1886, and the indications are that they are good for 10 years yet if they do not rot out under the cap. On another part of our road the piles would not last to exceed eight or ten years.

Mr. Sattley.—What kind of timber is in those piles?

Mr. A. S. Markley.—White oak.

Mr. Sattley.—I have some cedar piles that have been in 18 years. It depends on the wood in our part of the country.

Mr. Steffens. Replying to Mr. Penwell's statement. The Bureau of Forestry has mentioned casually this question of petroleum as a preservative, but it is still in too elementary stage to discuss largely and so was eliminated from the report of the committee. It is undoubtedly true that petroleum oil is a preservative, but it would seem very undesirable to render timbers inflammable by impregnating them with this material. As to the point mentioned by Mr. Shane. Mr. J. B. Adams is the chief of the Bureau of Forestry and undoubtedly members can have their names placed on the mailing list by writing to him.

President.—We have a letter from the Bureau of Forestry, inviting our members while at St. Louis to visit the timber treating plant, which is at the World's Fair grounds in the mining gulch.

Mr. Schwartz.—I should like to ask some of the members where they get their white oak piles. We get all ours from Missouri and Arkansas and they call it white oak, but it lasts in some cases only five years. They have several different kinds of piling down in that country, but it all comes as white oak. They have one kind that I call cow oak, and it does not last at all. We had several bridges that only ran five years. The piling rots off and by that time it does not pay to put the deck on again. On our road we use 6 x 8 inches x 12 feet of what they call white oak ties. After about four years we have to commence renewing them. They look pretty good, but if you split them you find that they are hollow.

Mr. Killam.—Mr. Schwartz speaks of cow oak. Cow oak is simply the same as what we call cow shade pine. That is a timber that grows apart from other trees in open space and has about 75 per cent. sap, it grows so fast. It looks well when you cut it, but will not last in ground that is dry, with hot air above it, for over four or five years. Any

timber that is cut in a thick forest where it is protected will last twice as long as that grown in the open country. Oak grown in a thick forest is good wood.

Mr. A. S. Markley.—The bridges I referred to were of white or burr oak. The oak that Mr. Schwartz has been getting is what we call jack oak and is a grade of material that we are treating for ties. A great deal of this oak is going through on our line to the Northwest and is undoubtedly being sold for white oak. In treating timbers from the outside, as mentioned by Mr. Reid, my experience has been that with timbers having a large diameter, when tearing down old trestle work, you will find dry rot in the center of the timber formed by sap fermentation. I have cut down many a pile and on the outside it would be hard, while on the inside it would be rotten.

Mr. Shane.—I just want to say a few words about cow oak. I quite recently had an experience of a very extensive nature in that respect. We are not explicit enough in our specifications. If you order white oak and you get oak, you must not be disappointed, because I have it from the best authority in the United States that cow oak is white oak. There are but two classes of oak and if you desire to get good timber you must eliminate all these sub-classes in your specifications. In many instances cow oak assumes a reddish color, but I found, when submitting it to the United States Department of Forestry, that they pronounced what many of our people had called red oak and some cow oak as being white oak, and the man who furnished the timber had complied with the specifications. If we do not want to be imposed upon we must pay more attention to our specifications.

Mr. Reid.—I would like to ask if any of the members have had much experience with yellow pine timber, almost entirely sap, which had been treated. The creosoting companies endeavor to get as much sap wood as possible so as to get the creosote in. Does this sap wood have any strength after being treated?

Mr. King.—In connection with that I would say that we have been using Oregon fir for a good many years. With that wood we find that the sap wood very readily takes up the salt, and we have piles that are as sound now as when driven 20 or 25 years ago. I believe that the sap portion of the timber more readily absorbs the solution.

Mr. Killam.—We have had some experience with yellow pine creosoted. We have one bridge 400 feet long and another 2,900 feet long. They were both built in 1884. On the 400-foot bridge we took off the stringers and caps two years ago and found that the piles were as good as the day they were put in, so far as could be seen, although they were yellow pine with a good deal of sap on them. With the long bridge there is 38 feet of water in the deepest part of the river or harbor, which is subject to worms. Four years ago we examined this bridge with a marine diver and found that the worms had eaten it some, and this year we replaced some piles. So far as decay was concerned, there was not a sign of rot on the piles above water 12 feet. I noticed some of the new piles that we cut off. They were all thick sap, but the creosoting had gone pretty well through the sap, in some places entirely through. So far that bridge has been in 20 years and time has had no effect on the piles above water. It is the worms only that have damaged them. The great object is to get the creosoting well done. I noticed that those that had the most sap had received the most creosote and are still in good order.

Mr. Reid.—The question I had in mind was not so much the preservation of the wood but the strength of the timber after it is creosoted. Yellow pine sap wood has practically no strength at all in ordinary condition and the question is, Does this creosoting increase the strength? Take timber that has to bear transverse strain, is creosoted sap wood any good for that purpose?

Mr. Steffens.—Answering Mr. Reid's inquiry. The Bureau of Forestry has made some breaking tests but while

thus far the figures indicate increased strength, they are not accepted as conclusive. The bureau will undoubtedly issue a valuable report after more tests have been made. Another point—thorough seasoning should be given. This is a matter that seems to have been neglected. The hand to mouth policy of buying lumber green from the forest and using it in a structure at once is only too customary. Thorough steaming, in the event that seasoning cannot be resorted to, is doubly important. The steaming must be continued a sufficient length of time to penetrate the heart of the timber. This result is not secured ordinarily. The fact that the heat has not penetrated certain cells makes it possible for the mycelium to propagate in those cells.

Mr. A. S. Markley.—The ties that we buy for treating purposes are all piled on our right of way by the parties who get them out and are taken up and dated at the time they are received. They, of course, are allowed to remain and season a reasonable time before they are sent to the treating plant where they are treated. This is in order that they may take a proper amount of the material which is used in treating them.

Mr. Alexander.—There has been considerable said about creosoting, and I have had no particular experience in this. Referring to other methods: We have used some of the woodiline on bridge floors. We heat the woodiline and put on with a brush as much as we can after the timbers are in place. The object is to preserve the sap wood. At the present time it seems to be showing up well and to add enough to the life of the wood to pay for putting it on. It seems to keep the wet out of the wood. We have used this material in painting roofs and shingles, mixing it with other paints, and it seems to be very good. I have not tried any other preservatives.

Mr. Steffens.—Supplementing Mr. Alexander's remarks. The process of using woodiline or some other preservative, in places where timber surfaces come in contact is very valuable, and has been used by several roads successfully. One

good place for its application is where an elevation block is placed on top of the cap to secure elevation for the outer rail where a trestle is on a curve. The shim block in this case is often beveled down to as small dimensions as 1½ to 1 inch at the end. At the end of three or four years this block is often decayed, whereas the application of a preservative would have lengthened its life materially.

Mr. J. F. Parker.—This is a subject of considerable interest to me. On my division we have over 40,000 lineal feet of pile and timber trestle bridges. Our piling and bridge timber is mostly Oregon fir. These piles, untreated in some localities, according to the soil, do not last more than six years. We have some creosoted piles that have been in service 22 years and are still in good condition.

Our experience has also proven that salt is a good preservative for piles. We have used a good many that have been taken out of wharves which were impregnated with sea salt, and have found that such piles last twice or three times as long as new, untreated piles. We have a number of bridges along the cost in salt alkali marshes where the piles have been in service 22 years and are still perfectly sound.

As a preservative for framed bents and deck timbers, we apply a liberal application of crude oil, which costs only 50 cents per barrel. This penetrates the wood and, during our long, dry summers, prevents checking; also in the rainy season it keeps out moisture and prevents rot, and besides it improves the looks of a structure.

In 1897, when we had over 60,000 lineal feet of wooden bridges, we fitted out a gang and painted all our bridges with crude oil. We do not consider that this adds anything to the fire hazard, but rather lessens it.

Our bridge gangs are kept supplied with crude oil and in repair work all new timber put in is thoroughly filled.

Mr. Schwartz.—I should like to ask the members where they find that piling gives out first. We find that when

we dig the earth away the decay is at the surface of the ground.

Mr. Steffens.—The member's difficulty is probably due to unfamiliarity with the conditions that produce decay. That is fully treated in our report. Air, moisture and warmth are the three necessary conditions. Moisture is found at the ground line, and all fence poles, telegraph poles and piles will begin to decay there first.

Mr. Alexander.—It varies with the place where piles are driven. In dry grounds and side hills you find it near the surface, and above that there is little rot. You may cut it off a foot above the surface or a foot below the surface and find it perfectly sound. Again you will find where a pile stands in wet ground that it will rot about three or four feet above where it remains wet. A pile like this that is allowed to stand is very dangerous because it is altogether gone. It must be watched very carefully and attended to sooner than if rotting at the surface. These conditions are altogether due to the soil.

Mr. Reid.—Speaking of creosoting piles. I want to ask if any of the members creosote the part of the pile that is exposed to the air. It seems that in some cases it might be advisable to creosote some of the piles exposed to the atmosphere.

President.—I think we have covered this subject pretty thoroughly, gentlemen, and if there is no objection, we will pass to the next subject.

XII.—Best Method of Protecting Low Overhead Structures over Tracks from Gases and Blasts of Locomotives.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

Your committee appointed to investigate the above subject, No. 12, beg to submit the following report:

The chairman of this committee, Mr. B. W. Guppy, was taken sick and went to the hospital for an operation. After some correspondence, he requested me to attend to subject No. 12, which I have done to the best of my ability.

I obtained some fifty circulars and sent them out to different members of the Association, including each of the remaining members of this committee.

I herewith submit all the information I have been able to obtain, and for the small number of answers received I consider we have a very valuable lot of information.

Very truly yours,

Grosvenor Aldrich,
For the Committee.

P. S. I could add that we have a tunnel under a hotel where the hotel is supported by box girders, and the under side of these girders was covered with expanded metal and two coats of cement plaster. We have had no trouble with the cement but have had trouble with the expanded metal rusting off and the whole thing falling down. When this was originally built it was put on in plenty of time for it to set up and get in good shape before any engine passed under it. The original coating has all fallen off, as I have said, on account of the expanded metal rusting off, and we had it put on again one year ago, but it has nearly all come off the second time. We have about 70 regular trains which pass under this structure, exhausting steam. It is only about 250 feet from where trains stop at station. The trains on the express tracks, which I refer to, are long, heavy trains, the locomotives of which are exhausting rapidly. Considerable moisture gets into the plaster from somewhere which seems to affect this expanded metal. I have concluded that in a new structure it is best to provide metal enough to stand the wear of the blast, and to put on paint that will take care of the gases by applying it so often that the gases cannot reach the iron. I have had better success with graphite paint for this kind of work than any other. There is no danger

of the iron rusting out where you sand blast it off seventy times a day as we do this. This structure is about fifteen feet above the top of the rails.

Very truly yours,

GROSVENOR ALDRICH.

B. W. Guppy, Chairman Committee Subject No. 12, A. R. S. of B. & B., Portland, Me.:

I have no hesitation in saying concrete, in answer to the question as to the best material to be used for protection of any style of metal overhead bridge. The concrete to be made of Portland cement, and an aggregate not exceeding pea size.

As to the best method of application: The concrete must be applied in some way so that it will be homogeneous and continuous throughout. Expanded metal under lower flanges is excellent to reinforce the concrete, but it must be embedded in the concrete at least one inch clear of the flange.

Great care and very wet concrete must be used in conjunction in order to get a proper bond with the work above. If the under side of the flanges are packed first, and the edges of the expanded metal, or other bonding material, left exposed with the idea of being later packed in concrete arches or other filling, there will result a joint between the hardened concrete under the flange and the filling work that will admit engine gases which will rust off the reinforcing metal, and sooner or later the concrete below the flanges will drop off. This result has happened, and it gives a bad name to concrete protection, while the fault lies with the method of doing of the work rather than with the material or general method.

Without doubt the best results would be obtained from a design of iron work that would admit a form of matched boards suspended by wires about two inches below the iron, and then to fill the whole with very soft, fairly rich, concrete. The outsides of girders or trusses should be covered as well as the inside.

A great help to ordinary paint is a close sheathing of matched boards under the iron work, which presents a plane surface underneath. In this case the rush of air from the passage of the cars following an engine cleanly sweeps the gases from under the bridge so there is very little opportunity for the acids to get in their work. Where the floor is framed in the ordinary way, the smoke lingers a long time under the bridge until it cools enough to drop out of the pockets of the framework by gravity.

The ordinary method of protection is by paint. This, for structures subject to engine gases, should not be made of metallic pigment of any kind. These gases where severe will cut the best lead paints as quickly as naked iron. Only inert pigments should be used. Carbon, graphite, or gums are not so affected.

J. P. SNOW.

CLEVELAND, OHIO, Aug. 22, 1904.

B. W. Guppy, Portland, Me.:

DEAR SIR: Answering your circular letter relative to subject No. 12, of the A. R. S. B. & B. committee reports in regard to best material to be used for protection of separate style of overhead structures, also best method of application of kinds of materials to be used, I plead "not guilty," as I do not know of a thoroughly good protection against smoke, gases, and cinders which is practicable of application on overhead bridges. We are "up against" that proposition hard on the Lake Shore, and have used paint in liberal quantities and at frequent intervals to endeavor to preserve our structures, but not with entire satisfaction up to the present, though we hope by more liberal and frequent use of first-class paint to improve the conditions. I think the subject one of vital importance and worthy of thorough investigation and discussion, and trust that it may receive thorough discussion, even if you are unable to get much material in the way of a report.

Yours very truly,

R. H. REID.

TYLER, TEX., Aug. 25, 1904.

Mr. G. Aldrich, 236 *Milton Street, Readville, Mass.:*

DEAR SIR: I beg to acknowledge receipt of yours enclosing blanks on subject No. 12, best method of protecting low overhead structures over tracks from gases and blasts from locomotives.

I consider the best method of protecting low overhead structures from smoke and gases and from blasts from locomotives is to keep the structures well protected with a good quality of paint. There are quite a number of paints specially made for protecting against locomotive smoke and gases that I believe would stand the test. I do not think it is practicable to cover bridges on the under side, as I would consider it a dangerous practice. The covering might become loose, and, by sagging, cause an accident to men on top of freight cars while trains are passing under, or it might fall on the train and do damage.

The matter is one in which I am not prepared to make definite recommendations.

Yours truly,

J. S. BERRY.

BOSTON, Aug. 20, 1904.

Association Railway Superintendents of Bridges and Buildings, Subject No. 12*:*

Protection of low overhead structures from gas and blast action from locomotives.

Only a small proportion of such surfaces will be subjected to blast action, usually not to exceed about 30 inches in width directly over the centers of tracks.

The subject should therefore be considered under two heads: *A*, metal exposed to gas only; *B*, metal exposed to gas and blast action.

A. Metal exposed to gas only, hot or cold, wet or dry, can be positively protected by coating it with any inert, incorrodible substance. Ordinary paint does not fill the bill.

A coating of hot asphalt applied to heated iron has in some cases proved entirely effective. Care must be taken that the asphalt is so manufactured, or rather, refined, that it will contain little volatile matter, and of such origin and quality that it will not grow brittle and crack. It is easy to fail in either direction.

Asphalt cut or dissolved in fluids, such, for example, as carbon disulphide, and applied cold, drying by evaporation, leaves a porous coating, and is consequently of little value unless burned or baked on. Possibly some other substance could be found which would improve the mixture.

Linseed oil, which forms the base of all ordinary paints, even when pure, is destructively affected by sulphurous acid. So, also, are most, if not all, varnishes. In many cases, however, especially of old structures, nothing but paint can be used, and it becomes necessary to make the best of a bad matter and use the best paint possible. Some experiments made eight years ago indicate the value of a paint made by adding powdered graphite to an ordinary red lead paint mixed as thick as brushes will work. The eight years' test shows that with not too severe conditions such paint, two coats, will last eight, and possibly ten, or more years.

The philosophy of it is that the red lead and oil form a cement which holds the graphite in place. The surface consists of graphite, which resists the action of acid and water as well as gas direct.

Of course any paint must be applied to a clean surface. This is difficult to obtain, but a *sine qua non* for success. The deservedly much lauded sand blast will do the trick, but it must be used with discretion. The sand will cut iron or steel surprisingly fast.* Iron, when kept properly painted, should have little need of sand blast cleaning.

B. The sand blast action of a locomotive exhaust adds a very serious complication. On lines of heavy traffic it will cut through a 1-inch pine board in three months. About thirty trains a day starting from a station stop will cut through 1½-inches of Portland concrete in about four years. Concrete reapplied will not last nearly so long.

*The experience of the Wolff Bicycle Company entirely refutes this theory. A piece of thin tubing was held continuously in the current from a sand blast machine for twenty minutes. At the end of that time, with a micrometer caliper, measuring to one thousandth of an inch, no diminuation in the size of the tube was apparent. See Transactions American Society Civil Engineers for June, 1903.—ED.

In a comparatively recent bridge near Boston the bottom flanges of I beams were covered with a $\frac{1}{16}$ inch sheet of lead. This lasted some six months under very unfavorable conditions. Possibly a plate of say $\frac{1}{4}$ inch would be better, as it would tend to cushion the blast action. The writer would like to see this tried.

Another promising possibility is a cloth, not felt or paper but woven fabric composed largely of asbestos or similar fibrous incombustible material soaked in raw asphalt, that is, asphalt of decidedly sticky, pitchy nature. This should cushion the blast, protect the iron, be easily applied, and not too expensive.

Either lead or asphalted cloth could profitably be limited to a width of say thirty inches directly over track center, as only there is the sand blast effect seriously destructive.

H. K. HIGGINS.

BOSTON, MASS., Aug. 18, 1904.

G. Aldrich, Supervisor Buildings and Bridges, Prov. Div., N. Y., N. H. & H. R. R. Readville, Mass.:

DEAR SIR: I have your letter of the 12th inst., enclosing circular of Railway Superintendents Association.

A number of different methods have been tried for protecting metal work of low overhead structures from locomotive exhaust. In connection with work on which I have been engaged during the last fifteen years, wood sheathing, made from tongued and grooved stock, properly supported, has been used with fair success, but is not entirely satisfactory on account of shrinkage, allowing gas to escape through the cracks and also danger of fire. A simple coating of paint is of no use whatever. Some mixtures of asphalt and black oil, applied hot, have stood much better than paint. The most satisfactory protection has been Portland cement plaster, attached to metal work with expanded metal, the plaster being put on in two coats; first a scratch coat, made up of cement, lime, and sand in proportions respectively $1\frac{1}{6}$, and put on about $\frac{3}{4}$-inch in thickness, and the second coat Portland cement and sand, portion of $\frac{1}{2}$ respectively. It is quite necessary with this plaster protection to prevent any moisture from reaching the work, as the action of frost will disintegrate the protection. In connection with this subject it may be of interest to state that in the train shed at the Boston Terminal, it is found that the cold condensed gases from locomotives do most damage; in some cases completely destroying 14-ounce copper in less than two years. Hot locomotive gases seem to have very little effect on the metal work where the latter is not exposed directly to the blast.

I trust that this information will be of service to you.

Yours truly,

E. J. BEUGLER.

PROVIDENCE STATION, Sept. 17, 1904.

Mr. B. W. Guppy, Chairman Subject 12 *of* 1904, *Portland, Me.:*

GENTLEMEN:—While greatly interested in this subject, as we have many structures of this class, I cannot answer your questions, as until recently nothing but paints have been used by our company so far as I know. These have all been unsatisfactory. A short time ago some steel bridges in Fall River, Mass., were plastered over with Portland cement and sand mixed, I think, about two and one. This was put directly on the steel, about three-fourths of an inch thick, with a reinforcing of wire cloth in the center. If this does not flake off or crack by the water getting in from the top, it should protect the steel.

Yours truly,

J. B. SHELDON,
Supervisor N. Y., N. H. & H. Ry.

DISCUSSION.

President.—Mr. Guppy, the chairman of this committee, was taken sick, and Mr. Aldrich has made a report. I will ask Mr. Aldrich if he has anything further to offer.

Mr. Aldrich.—I do not think I have anything further than what is shown in the report, of which all the members have a copy. We were vitally interested in that subject in my vicinity, so I took up the subject, and I would like to hear it discussed.

We have a number of structures under which 70 trains per day pass over one track. We put on a cement concrete, which has entirely come off. It was made of lime and cement of about 1½ inches thickness, and put on expanded wire metal, turned over the corners of box girders some 2½ feet in width. Over this we put about ¾ inch of about 1 to 2, then a finish coat of about ½ inch thickness of 1 to 1. Our trouble has been with the expanded metal. The cement has not given out, but at the corners the expanded metal has rusted off and the whole thing has dropped. We undertook to put it on a second time where we could only have the use of the track 24 hours. This did not give our cement a chance to harden properly, and it has all come off the second time and for the same cause, the expanded metal having rusted at the corners.

Mr. Steffens.—Mr. Aldrich's remarks remind me of an experience on our line with the same sort of a structure over main tracks, where cement was reinforced with wire netting. There was little time to allow it to set, as traffic was very heavy, but it was as well done as good inspection could make it. It cracked, however, allowing the gases to get in between the protecting shield and the structure itself, which, of course, is more dangerous than would be an open floor. The shield has lately been removed. That form of protection must be improved upon if it is to be used any further.

The experience of the city of Columbus in protecting overhead structures by means of $\frac{7}{8}$-inch wooden sheathing has been instructive. If any of our members are from that section of the country, they can undoubtedly discuss this method further.

Mr. R. H. Reid.—Speaking of $\frac{7}{8}$-inch wooden sheathing, that is also used at Buffalo under the bridges over the tracks there. It is a protection against the direct action of cinders and the hot blast action of smoke and gases, but I do not think it is an entire protection against acid and steam, as I think they will get under the sheathing and there is no way to inspect the steel after the sheathing is up. The rusting will not go on as fast, perhaps, but it will rust.

Another method of protection is to place on the under side of the structure a concrete coating about an inch thick and securing it with expanded steel. I saw several large patches approximately an inch thick where it had fallen off. I did not see any places where thicker material had dropped away. It is a question as to whether concrete can be placed on steel subject to vibrations and remain for any length of time. If it loosens, of course the moisture will get in, rusting will commence and the bridge will soon be just as bad off as if only painted. There has been a method used by some of putting on a coating of hot asphalt. This will stand the expansion and contraction of the iron and the vibration and it seems pretty difficult to get it off after it has been put on. The Michigan Central and some other roads use it. It is rather difficult to apply, and for that reason it may not be practical to put it on from below.*

All the paints that we have used so far on the Lake Shore have not been entirely successful. I am taking out a bridge now at Toledo, where parts of the structure are entirely rusted away. From our roundhouse roofs—while these do not come under the classification of low overhead struc-

*One prominent trunk line tried this method, to its sorrow. Today it is doing its best to remove the coatings, which have proved a failure.—Ed.

tures, they are subject to the same conditions—I have taken out iron bars originally $2\frac{1}{2} \times \frac{1}{2}$ inches that were entirely rusted away. Whether there is a paint that will give protection is a question. Many of them are claimed to be good and some of them may be, but our experience with paint is that we cannot get anything that will give complete protection.

Mr. Steffens.—Supplementing the remarks of Mr. Reid. We think we have found the ideal article in the line of protective coating for metal. One of the representatives of the company that manufactures it is at our Convention. It is a protective coating that can be applied to iron even when rusty. We have tried Portland cement paint. That was an absolute failure. In the interim between the last meeting and this the coating has almost entirely fallen off and we will have to try something else. If by the paint mentioned we can protect against the blasts of locomotives, I think we have found at last the article we have been looking for. It is acid proof and proof against temperature changes, and possibly it may be the means of protecting our floors against the dripping of refrigerator cars referred to last year. In the year to come several of us hope to experiment with it. I would be well to continue next year the subject under discussion, as is our custom, that the results secured may be made known.

Mr. Sheldon.—Do I understand Mr. Steffens to say he has solved this problem? If he has, I think there are many of us who would like to learn his method. With some of us this is a serious thing, as we have numerous bridges deteriorating very fast from the gases and blasts from locomotives. While certain kinds of paint may stand the gas, the cinders thrown out by the exhaust soon wear the paint off, leaving the metal without protection. On the N. Y., N. H. & H. R. R. there are many valuable structures which will need to be renewed in one half the time they would if they could have been properly protected from gases and blasts from exhaust of locomotives.

Mr. Aldrich.—Referring to wooden protection on the under side of bridges. I think in a good many cases cold condensed gases do more damage than hot gases. It is very difficult to get wood on so that it will keep gases out, and when they once get in there they condense. The resident engineer of the South Terminal Station in Boston states that cold condensed gases will cut copper all to pieces in two years, while hot gases have very little effect. On our division we had a water pipe that ran under a bridge and was protected with a wooden box. Where this box adjoined the edge of the iron girder it formed a space into which the gases penetrated. After it had been in there a few years our girders were badly damaged, much more so than had they been exposed to the air. We persuaded the city authorities to consent to have the box taken off, and have had better results since, which shows us that cold condensed gases can do more damage than hot gases.

Mr. Killam.—In connection with the inspection of the 1,700 miles of road with which I am connected, we find difficulty in properly protecting low overhead bridges and steel work in roundhouses. The principal source of this trouble is that the proper painting of these structures is not attended to at frequent enough intervals. Among all the paints tested thus far we have found iron oxide paint and Carson's anti-corrosion paint to be most satisfactory. Other brands do not stand the blasts of locomotives. Our standard test is to coat a piece of iron twelve inches square and hang it over the side of a bridge, where it is exposed to the action of fog and salt spray.

LIST OF ANNUAL CONVENTIONS.

First,	St..Louis, Mo.,	September 25, 1891.
Second,	Cincinnati, Ohio,	October 18, 19, 1892.
Third,	Philadelphia, Pa.,	October 17 to 19, 1893.
Fourth,	Kansas City, Mo.,	October 16 to 18, 1894.
Fifth,	New Orleans, La.,	October 15, 16, 1895.
Sixth,	Chicago, Ill.,	October 20 to 22, 1896.
Seventh,	Denver, Col.,	October 19 to 21, 1897.
Eighth,	Richmond, Va.,	October 18, 19, 1898.
Ninth,	Detroit, Mich.,	October 17, 18, 1899.
Tenth,	St. Louis, Mo.,	October 16 to 18, 1900.
Eleventh,	Atlanta, Ga.,	October 15 to 17, 1901.
Twelfth,	Minneapolis, Minn.,	October 21 to 23, 1902.
Thirteenth,	Quebec, Canada,	October 20 to 22, 1903.
Fourteenth,	Chicago, Ill.,	October 18 to 20, 1904.

MEMBERSHIP.

Year 1891–2. . . .	Number of active members, 60.
Year 1892–3. . . .	Number of active members, 112.
Year 1893–4. . . .	Number of active members, 128.
Year 1894–5. . . .	Number of active members, 115.
Year 1895–6. . . .	Number of active members, 122.
Year 1896–7. . . .	Number of active members, 140.
Year 1897–8. . . .	Number of active members, 127.
Year 1898–9. . . .	Number of active members, 148.
Year 1899–1900. . .	Number of active members, 148.
Year 1900–01. . . .	Number of active members, 143.
Year 1901–02. . . .	Number of active members, 171.
Year 1902–03. . . .	Number of active members, 195.
Year 1903–04. . . .	Number of active members, 223.
Year 1904–05. . . .	Number of active members, 293.

LIST OF OFFICERS OF THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS FROM ITS ORGANIZATION TO THE YEAR 1904-1905.

YEAR.	1891-2.	1892-3.	1893-4.	1894-5.
President	O. J. Travis	H. M. Hall	J. E. Wallace	Geo. W. Andrews.
First Vice-President	H. M. Hall	J. E. Wallace	Geo. W. Andrews	W. A. McGonagle.
Second Vice-President	J. B. Mitchell	G. W. Hinman	W. A. McGonagle	L. K. Spafford.
Third Vice-President	James Stannard	N. W. Thompson.	L. K. Spafford	James Stannard.
Fourth Vice-President	G. W. Hinman	C. E. Fuller	E. D. Hines	Walter G. Berg.
Secretary	C. W. Gooch	S. F. Patterson	S. F. Patterson	S. F. Patterson.
Treasurer	George M. Reid	George M. Reid	George M. Reid	George M. Reid.
Executive Members	W. R. Damon	G. W. Andrews	Quintine McNab	James Stannard.
	G. W. Markley	Joseph M. Staten.	Aaron S. Markley	James H. Travis.
	W. A. McGonagle	J. M. Caldwell	Floyd Ingram	Joseph H. Cummin.
	G. W. McGehee	Quintine McNab	James Stannard	R. M. Peck.
	G. W. Turner	Floyd Ingram	James H. Travis	J. L. White.
	J. E. Wallace	Aaron S. Markley	Joseph H. Cummin	A. Shane.

YEAR.	1895-6.	1896-7.	1897-8.	1898-9.
President	W. A. McGonagle	James Stannard	Walter G. Berg	Joseph H. Cummin.
First Vice-President	L. K. Spafford	Walter G. Berg	Joseph H. Cummin	Aaron S. Markley.
Second Vice-President	James Stannard	Joseph H. Cummin	Aaron S. Markley.	C. C. Mallard.
Third Vice-President	Walter G. Berg	Aaron S. Markley	G. W. Hinman	Walter A. Rogers.
Fourth Vice-President.	Joseph H. Cummin	R. M. Peck	C. C. Mallard	Joseph M. Staten.
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson.
Treasurer	George M. Reid	N. W. Thompson	N. W. Thompson	N. W. Thompson.
Executive Members.	R. M. Peck	W. O. Eggleston	George J. Bishop	Wm. S. Danes.
	J. L. White	W. M. Noon	C. P. Austin	J. H. Markley.
	A. Shane	Joseph M. Staten	M. Riney	W. O. Eggleston.
	Aaron S. Markley	George J. Bishop	Wm. S. Danes	R. L. Heflin.
	W. M. Noon	C. P. Austin	J. H. Markley	Frank W. Tanner.
	Joseph M. Staten	M. Riney	W. O. Eggleston	A. Zimmerman.

LIST OF OFFICERS OF THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS FROM ITS ORGANIZATION TO THE YEAR 1904-1905.

YEAR.	1899-1900.	1900-1901.	1901-1902.	1902-1903.
President	Aaron S. Markley	W. A. Rogers	W. S. Danes	B. F. Pickering.
First Vice-President	Walter A. Rogers	W. S. Danes	B. F. Pickering	C. O. Mallard.
Second Vice-President	Joseph M. Staten	B. F. Pickering	A. Shane	A. Shane.
Third Vice-President	Wm. S. Danes	A. Shane	A. Zimmerman	A. Zimmerman.
Fourth Vice-President	B. F. Pickering	A. Zimmerman	C. C. Mallard	A. Montzheimer.
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson.
Treasurer	N. W. Thompson.	N. W. Thompson	N. W. Thompson	N. W. Thompson.
Executive Members	T. M. Strain	T. M. Strain	A. Montzheimer	W. E. Smith.
	R. L. Heflin	H. D. Cleaveland	W. E. Smith	A. W. Merrick.
	F. W. Tanner	F. W. Tanner	A. W. Merrick	C. P. Austin.
	A. Zimmerman	A. Montzheimer	C. P. Austin	C. A. Lichty.
	H. D. Cleaveland	W. E. Smith	C. A. Lichty	W. O. Eggleston.
	A. Montzheimer	A. W. Merrick	W. O. Eggleston	J. H. Markley.

YEAR.	1903-1904.	1904-1905.	1905-1906.	1906-1907.
President	A. Montzheimer	C. A. Lichty		
First Vice-President	A. Shane	J. B. Sheldon		
Second Vice-President	C. A. Lichty	J. H. Markley		
Third Vice-President	J. B. Sheldon	R. H. Reid		
Fourth Vice-President	J. H. Markley	R. C. Sattley		
Secretary	S. F. Patterson	S. F. Patterson		
Treasurer	C. P. Austin	C. P. Austin		
Executive Members	R. H. Reid	W. O. Eggleston		
	W. O. Eggleston	A. E. Killam		
	A. E. Killam	H. Rettinghouse		
	R. C. Sattley	J. S. Lemond		
	H. Rettinghouse.	W. H. Finley		
	J. S. Lemond	C. W. Richey		

SUBJECTS FOR REPORT AND DISCUSSION, AND COMMITTEES SELECTED AT EACH CONVENTION SINCE ORGANIZATION OF THE ASSOCIATION IN 1891.

FIRST CONVENTION, ST. LOUIS, MO., SEPTEMBER 25, 1891.

Subjects.	Committees.
1. Surface Cattle-Guards	Aaron S. Markley, J. B. Mitchell, W. R. Damon.
2. Frame and Pile Trestles Complete, including Rerailer	H. M. Hall, W. A. McGonagle, G. W. McGehee.
3. Framing and Protection of Howe Truss and Other Wooden Bridges against Fire and Decay	J. E. Johnson, G. W. Markley, J. H. Markley.
4. Iron and Vitrified Pipe for Waterways under Railroad Embankments	James Stannard, J. O. Thorn, J. E. Wallace.
5. Water-Tanks Complete, including Painting, Pumps, Pump and Coal Houses, Wells and Reservoirs	G. W. Turner, R. K. Ross, Q. McNab.
6. Interlocking Signals	B. F. Bond, G. W. Hinman, James Demars.
7. Depot Platforms, Complete	J. A. Nicholson, Adam McNab, C. B. Keller.
8. Paints for Iron Structures	Geo. M. Reid, A. J. Kelley, H. A. Hanson.

SECOND CONVENTION, CINCINNATI, O., OCTOBER 18 AND 19, 1892.

Subjects.	Committees.
1. Discipline, and Benefits Derived, and Who are the Beneficiaries	Geo. W. Andrews, W. R. Damon, T. M. Strain, G. W. Turner.
2. Turn-table, Best, with a View of Economy, and Durability, and Strength	G. W. Markley, H. F. Martin, James H. Travis, Charles Walker.
3. Water Columns, Best, Cheapest, Simplest, and Most Durable	C. E. Fuller, A. S. Markley, H. N. Spaulding, E. L. Cary.
4. Coaling Stations, including Storage Bins and for Coaling Engines	J. E. Wallace, C. W. Gooch, G. W. Hinman, J. H. Cummin.

5.

Crawling of Rails, and its Effects on Structures......	Geo. M. Reid, L. K. Spafford, J. B. Mitchell, L. S. Isdell.

6.

Guard-Rails on Bridges, Advantages and Disadvantages, and Best to be Adopted........................	O. J. Travis, Q. McNab, J. F. Mock, J. M. Staten.

7.

Platforms, Height and Distance from Rail and Mode of Construction..	James Stannard, M. Walsh, N. M. Markley, Robert Ogle.

8.

Best Bridge, Wood, Combination, or Iron, from 130 feet and upwards, and the Best Method of Reconstruction..	A. Shane, Walter Ransom, N. Potter, C. G. Worden.

9.

Best Method of Elevating Track upon Bridges and Trestles..................	H. E. Gettys, S. F. Patterson, G. W. Hinman, P. A. Watson.

THIRD CONVENTION, PHILADELPHIA, PA., OCT. 17, 18, AND 19, 1893.

1.

Depressed Cinder Pits and Other Kinds...............	W. G. Berg, Abel S. Markley, G. W. Andrews, C. E. Fuller.

2.

Best Method of Bridge Inspection.....................	G. M. Reid, J. M. Staten, E. T. Wise, J. S. Berry.

3.

Pumps and Boilers..	G. W. Markley, G. W. Turner, J. B. Mitchell, J. R. Harvey.

4.

Maintenance of Pile and Frame Trestle.........	W. A. McGonagle, J. H. Markley, Geo. C. Nutting, John Copeland.

5.

The Best Scale Foundation.............................	O. J. Travis, Joseph Doll, C. E. Wadley, T. M. Strain.

FOURTH CONVENTION, KANSAS CITY, MO., OCT. 16, 17, AND 18, 1894.

1.

Mechanical Action and Resultant Effects of Motive Power at High Speed on Bridges	G. W. Andrews, W. G. Berg, J. E. Greiner, E. H. R. Green.

2.

Methods and Special Appliances for Building Temporary Trestles over Washouts and Burnouts......	R. M. Peck, G. J. Bishop, A. B. Manning, C. D. Bradley.

3.

Strength of Various Kinds of Timber Used in Trestles and Bridges, Especially with Reference to Southern Yellow Pine, White Pine, Fir, and Oak...	W. G. Berg, J. H. Cummin, John Foreman, H. L. Fry.

4.

Best Method of Erecting Plate-Girder Bridges ...	H. M. Hall, J. M. Staten, G. W. Hinman, J. N. Pullen.

5.

Best and Most Economical Railway Track Pile-Driver........	J. L. White, A. C. Davis, J. F. Mock, James T. Carpenter.

6.

Sand Dryers, Elevators, and Methods of Supplying Sand to Engines, including Buildings........	Aaron S. Markley, H. A. Hanson, A. J. Kelley, J. O. Thorn.

7.

Span Limits for Different Classes of Iron Bridges, and Comparative Merits of Plate-Girders and Lattice-Bridges for Spans from 50 to 110 feet........	W. A. McGonagle, R. M. Peck, W. M. Noon, H. E. Gettys.

8.

Best Method of Spanning Openings too Large for Box Culverts, and in Embankments too Low for Arch Culverts........	James Stannard, L. K. Spafford, O. H. Andrews, F. W. Tanner.

9.

Best End Construction for Trestle Adjoining Embankments........	G. M. Reid, J. L. Soisson, N. M. Markley, R. J. Howell.

10.

Interlocking Signals........	J. H. Travis, W. S. Danes, R. L. Heflin, J. A. Spangler.

11.

Pumps and Boilers........	John H. Markley, O. J. Travis, A. Shane, G. W. Markley.

FIFTH CONVENTION, NEW ORLEANS, LA., OCTOBER 15 AND 16, 1895.

1.

How to Determine Size and Capacity of Openings for Waterways........	Aaron S. Markley, J. S. Berry, C. C. Mallard, J. L. White.

2.

Different Methods of Numbering Bridges. Should All Waterways be Numbered?........	A. Shane, W. O. Eggleston, J. L. Slosson, O. J. Travis.

3.

Drawbridge Ends, Methods of Locking; and under this head include Locking of Turn-tables........	H. M. Hall, James Stannard, H. Middaugh, C. C. Mallard.

4.

Protection of Trestles from Fire, including Methods of Construction........	R. M. Peck, T. H. Kelleher, A. McNab, W. M. Noon, G. W. Hinman, William Berry.

5.

Local Stations for Small Towns and Villages, giving Plans of Buildings and Platforms........	J. H. Cummin, N. M. Markley, J. H. Markley, C. G. Worden.

6.

Tanks, Size, Style, and Details of Construction, including Frost-proof protection to Tank and Pipes..	W. O. Eggleston, W. M. Noon, A. McNab, N. W. Thompson.

7.

Shearing of Rivets in Plate-Girders and Cause Thereof.. J. M. Staten, R. L. Heflin, J. H. Travis, G. M. Reid.

8.

Best and Uniform System of Report Blanks for Bridge and Building Department.................... G. J. Bishop, W. O. Eggleston, Onward Bates, M. Riney.

9.

Protection of Railroad Structures and Buildings from Fire.. R. M. Peck, L. K. Spafford, B. T. McIver.

10. Brought forward from 1894.

Mechanical Action and Resultant Effects of Motive Power at High Speed on Bridges.................... G. W. Andrews, W. G. Berg, J. E. Greiner, E. H. R. Green.

11. Brought forward from 1894.

Best and Most Economical Railway Track Pile-Driver.. J. L. White, A. C. Davis, J. F. Mock, J. T. Carpenter, G. W. Hinman.

12. Brought forward from 1894.

Span Limits for Different Classes of Iron Bridges, and Comparative Merits of Plate-Girders and Lattice Bridges for Spans from 50 to 110 feet............ W. A. McGonagle, R. M. Peck, W. M. Noon, H. E. Gettys, G. J. Bishop, Onward Bates.

13. Brought forward from 1891.

Interlocking Signals.................................... J. H. Travis, W. S. Danes, R. L. Heflin, J. A. Spangler.

SIXTH CONVENTION, CHICAGO, ILL., OCTOBER 20, 21, AND 22, 1896.

1.

Methods of Heating Buildings where Three or More Stoves are Now Used.................................. J. H. Cummin, George W. Hinman, George W. Markley, Wm. Berry.

2.

The Most Suitable Material for Roofs of Buildings of All Kinds.. R. M. Peck, G. W. Turner, W. M. Noon, N. W. Thompson.

3.

Roundhouse Construction, including Smoke-jacks and Ventilators.. Geo. W. Andrews, O. J. Travis, W. O. Eggleston, James T. Carpenter.

4.

Care of Iron Bridges after Erection.................. James H. Travis, T. M. Strain, H. M. Hall, Walter Rogers.

5.

How to Determine Size and Capacity of Openings for Waterways.. Walter G. Berg, Aaron S. Markley, Onward Bates, A. J. Kelley.

6.

Protection of Railroad Buildings and Other Structures from Fire	W. A. McGonagle, M. M. Garvey, J. D. Hilderbrand John Foreman.

7.

Designs for Ice-Houses	W. B. Yereance, C. M. Large, J. H. Markley, Geo. W. Ryan.

8.

Best End Construction for Trestles adjoining Embankments	C. C. Mallard, W. S. Danes, R. L. Heflin, A. C. Olney.

9.

Bridge Warnings for Low Overhead Structures	W. E. Harwig, M. A. Martin, E. H. R. Green, Joseph Doll.

10.

Stock-yards and Stock-sheds, including all Details of Construction	Geo. J. Bishop, W. R. Cannon, O. H. Andrews, James Brady.

11.

Floor System on Bridges, including Skew Bridges	W. G. Guppy, C. P. Austin, C. W. Gooch, F. W. Tanner.

SEVENTH CONVENTION, DENVER, COL., OCTOBER 19, 20, AND 21, 1897

1.

Pile-rings and Method of Protecting Pileheads in Driving	G. W. Hinman, Wm. S. Danes, F. Eilers, E. F. Reynolds, Wm. Carmichael, C. M. Large.

2.

Cost and Manner of Putting In Pipe Culverts	Walter A. Rogers, Frank W. Tanner, John H. Markley, A. H. King, B. F. Bond, O. H. Andrews.

3.

Best Floors for Shops and Roundhouses	A. W. Merrick, C. S. Thompson, Wm. O. Eggleston, M. F. Cahill, J. B. Pullen, James Gilbert.

4.

Roundhouse Smoke-jacks and Ventilation	George W. Andrews, Wm. O. Eggleston. Aaron S. Markley, R. J. Howell, J. T. Carpenter, A. McNab.

5.

Cattleguards and Wingfences	C. C. Mallard, C. S. Thompson, A. Zimmerman, L. H. Wheaton, O. W. Osborne, R. L. Heflin.

6.

Prevention of Fire in Railroad Buildings	John D. Isaacs, Wm. A. McGonagle, M. Riney, H. L. Fry, J. P. Snow, Wm. B. Yearance.

7.

Storage of Fuel, Oil, and Other Station Supplies at Way-stations..	Arthur Montzheimer. A. Shane, G. E. Hauks, J. E. Johnson, W. Z. Taylor, E. M. Gilchrist.

8.

Railroad Highway Crossing Gates.....................	Joseph H. Cummin. J. B. Sheldon, Wm. E. Harwig, G. W. Smith, J. E. Featherston, W. M. Noon.

9.

What Repairs, and How Can they be Safely Made, to Metal and Wooden Spans Without the Use of False-work	F. S. Edinger, B. W. Guppy, J. E. Greiner, John D. Isaacs, Walter A. Rogers, H. W. Fletcher.

10.

Care of Iron Bridges After Erection, including Best Method of Protecting Them From Injury by Salt Water Drippings from Refrigerator cars............	J. E. Greiner, B. W. Guppy, James McIntyre, T. M. Strain, A. J. Kelley, L. F. Goodale.

11.

Turntable Construction..................................	Onward Bates, J. B. Sheldon, D. K. Colburn, John Foreman, E. Fisher, Henry Goldmark.

EIGHTH CONVENTION, RICHMOND, VA., OCTOBER 18 AND 19, 1898.

1.

What is the Most Economical Method of Painting Railway Bridges and Buildings, and Best Material to use	A. Montzheimer, B. F. Pickering, H. D. Cleaveland, W. A. McGonagle.

2.

Life of Different Kinds of Timber in Bridges of Various Kinds, and Advisability of Protecting Same from the Weather..	B. W. Guppy.

3.

The Best Method of Constructing and Maintaining Highway and Farm Crossings.......................	J. H. Markley, W. O. Eggleston, T. M. Strain, O. J. Travis.

4.

Best Practical Sanitary Arrangement for Local Stations where there are no Water or Sewer Systems.	W. A. Rogers, J. B. Sheldon, C. H. Miller, J. McIntyre.

5.

Best and Most Economical Plant for Pumping Water for Water Stations..........................	A. Shane, A. S. Markley, R. L. Heflin, W. E. Smith.

6.

Necessary and Kind of Tools for the Proper Equipment of a Gang of Bridge Men.	G. J. Bishop, G. W. Hinman, M. Riney, A. Zimmerman.

7.

Best Snow Fence—Stationary and Portable	A. W. Merick, A. E. Killam, J. D. Isaacs, A. H. King.

8. Brought forward from 1897.

What Repairs and How Can They Be Safely Made to Metal and Wood Spans Without the Use of False Work	F. S. Edinger, J. E. Greiner, J. D. Isaacs, W. A. Rogers, H. W. Fletcher.

9. Brought forward from 1897.

Prevention of Fire in Railroad Buildings..............	G. W. Andrews, A. D. Schindler, W. E. Smith, S. B. Rice.

NINTH CONVENTION, DETROIT, MICH., OCTOBER 17 AND 18, 1899.

1. Brought forward from 1898.

Necessary and Kind of Tools for the Equipment of a Gang of Bridge Men................................	W. S. Danes, J. M. Staten, W. O. Eggleston, J. M. Caldwell.

2. Brought forward from 1898.

Best Snow Fence, Stationary or Portable.............	W. E. Smith, A. McNab, Geo. E. Hanks, A. W. Merrick. W. M. Noon.

3.

Best Method of Erecting Track Scales, Suspended or under Track........	H. D. Cleveland, Wm. M. Clark, C. P. Austin, J. T. McIlwaine.

4.

Is Concrete the Most Suitable and Economical Material for Bridge Piers and Abutments and Railway Culverts and Arches ?................................	W. A. Rogers.

5.

Hand *vs.* Air-riveting Power Used. Actual Cost Compared with Hand Work in the Field for the Erection of New Work and Repairing; also Drilling for Reinforcing old Spans.......................	A. B. Manning, A. Shane, Geo. J Bishop, O. J. Travis, F. W. Tanner, F. S. Edinger.

6.

Most Practical and Cheapest Bumper for Yard Terminals..	B. F. Pickering, A. A. Page, W. E. Harwig, A. E. Killam.

7.

Are Tie Plates on Bridge Ties a Benefit or a Detriment ?..	C. A. Lichty, A. Montzheimer, C. W. Vandergrift, H. W. Fletcher, F. S. Edinger, J. B. Sheldon.

TENTH CONVENTION, ST. LOUIS, MO., OCT. 16, 17, AND 18, 1900.

1.	Methods of Sinking Foundations for Bridge Piers in Depth of Water Twenty Feet and Under..........	G. W. Andrews, C. C. Mallard, O. A. Lichty, C. W. Gooch, C. S. Thompson, D. Robertson.
2.	Passenger Platforms at Way Stations, Best Material and Cost of Same....................	J. B. Sheldon, John I. Banks, N. H. LaFountain, L. H. Wheaton, Wm. A. Fort, A. McNab.
3	Slips for Ferry Boats Used for Transferring Railway Cars......................................	John D. Isaacs, H. D. Cleaveland, J. H. Cummin, Charles Carr, H. Rettinghouse, J. T. Carpenter.
4.	Best Method of Operating Turn-tables by Power....	F. E. Schall, J. E. Greiner, B. F. Pickering, Onward Bates.
5.	Auxiliary Coaling Stations; Best Design, Capacity, and Method of Handling Coal.........................	W. A. McGonagle, G. W. Smith, E. Fisher, J. P. Snow, B. F. Bond, R. B. Tweedy.
6.	Water Stations; Best Material for Foundations, Tanks, Substructure, Connections, Capacity, etc...	A. S. Markley, Charles Carr, W. O. Eggleston, A. J. Austin, A. Shane.
7.	Is it Best for Railroad Companies to Erect Their Own Steel Structures, or Let the Manufacturers Erect Them?...................................... ...	O. J. Travis, F. S. Edinger, A. B. Manning, James McIntyre, A. Zimmerman.
8.	The Best and Most Convenient Outfit Cars for Bridge Gangs, and Number of Men Constituting a Bridge Gang......................................	A. W. Merrick, S. S. Millener, Wm. M. Clark, A. A. Page, M. F. Cahill, W. E. Harwig, G. O. Lilly.

ELEVENTH CONVENTION, ATLANTA, GA., OCT. 15, 16, AND 17, 1901.

1.

Auxiliary Coaling Stations; Best Designs, Capacity, and Method of Handling Coal. Brought forward from 1900	W. A. McGonagle, G. W. Smith, E. Fisher, J. P. Snow, B. F. Bond, R. B. Tweedy.

2.

Roof Coverings, First Cost, Life, Efficiency, and Maintenance Expenses for Various Classes of Railroad Buildings	E. Fisher, R. H. Reed, J. S. Berry, J. P. Snow.

3.

Mail Cranes, First Cost, Efficiency and Maintenance of Various Styles in Use	A. S. Markley, F. Price, James Brady, G. W. Smith, D. W. Lum.

4.

Best Method of Protecting Low Overhead Structures Over Tracks from Gases and Blast of Locomotives.	G. W. Andrews, J. S. Lemond, C. M. Large, A. H. King, James T. Carpenter, E. H. R. Green, A. E. Killam.

5.

What has been the Experience in the Use of Concrete Under Bridge Bedplates and Turn-tables in Place of Pedestal Stones, and What is the Best Form and Material for Bedplates Under Various Styles of Iron Bridges?	W. A. Rogers, Frank W. Tanner, George J. Bishop, J. H. Markley, A. McNab, George E. Hanks.

6.

Best Design and Recent Practice in Building Railroad Track Pile Driver	T. M. Strain, A. W. Merrick, Chas. C. Mallard, A. B. Manning, W. M. Noon, W. T. Powell.

7.

Best Material and Designs for Roundhouse Pits, Including Drainage and Rail Fastings	Arthur Montzheimer, E. M. Gilchrist, J. W. Taylor, James Stannard, Onward Bates.

8.

Best Materials for Wearing Surface of Roadway of Highway Bridge Floors	W. O. Eggleston, B. F. Peckering, A. B. Sheldon, C. P. Austin, Joseph M. Staten, O. J. Travis.

TWELFTH CONVENTION, MINNEAPOLIS, MINN., OCT. 21 TO 23, 1902.

1. Best False Work for Rocky Bottom in Rapid Currents Where Piles Cannot be Driven.................	John P. Canty, H. H. Eggleston, O. D. Killebrew, F. F. Lloyd, A. C. Macy, J. E. Greiner.
2. Should Ties of Bridges be Gained so as to Leave Rail Without Camber, or Should Only a Portion of Camber Be Taken Out?............................	R. H. Reid, Onward Bates, H. D. Cleaveland, Henry Goldmark, J. E. Johnson, G. W. McGehee.
3. In Case One Arm of an Important Metal Drawbridge Over a Deep Stream Should be Wrecked, What is the Most Expeditious Way to Restore Railway and Water Traffic?..	John D. Isaacs, F. E. Schall, Geo. C. Nutting, W. M. Noon, A. McNab, Geo. W. Andrews.
4. What is the Best Form of Traveler to Use in Erecting Steel Railway Bridges of Spans up to Two Hundred Feet?.......................................	G. W. Smith, O. J. Travis, J. P. Snow, C. W. Kelley, Joseph M. Staten, F. W. Tanner.
5 Best Method of Protecting Solid Steel Floors of Bridges...	A. O. Cunningham, Geo. F. Powers, D. W. Lum, Albert C. Keith, C. P. Austin, F. E. Schall.
6. Best Plans for Small Tool Houses, Including Switchmen's and Car Repairers' Shanties, and Section, Tool, and Hand-car Houses..........................	J. B. Sheldon, H. E. Holmes, W. E. Bell, Geo. Mitchell, Ed. Gagnon, C. R. Walton.
7. Best Practical Sanitary Arrangements for Small Stations Where There Are no Water or Sewer Systems	J. H. Markley, F. J. Leavitt, Geo. J. Patterson, E. B. Ashby, T. J. Darracott, A. W. Merrick.
8. Best Method of Making Annual Inspection of Bridges and Culverts, and Form of Report to be Made......	Walter G. Berg, J. A. Dodson, C. F. Loweth, Arthur Montzheimer, A. Zimmerman, A. Shane. I. O. Walker.
9. Water Filters, or Other Methods of Purifying Water for Engine Use......................	R. C. Sattley, J. E. Greiner, Ed. M. Gilchrist, Geo. E. Hanks, A. B. Manning, James Rogers.

10.

Best Method of Storing Fuel Oil, With Appliances for Supplying Locomotives, Including Plan of Water Stations, Showing Relative Arrangements of Fuel and Water Supply.............................. — O. C. Mallard, J. S. Berry, Geo. J. Bishop, William Carmichael, W. M. Clark, I. W. Evans, E. Fisher.

11.

What Has Been the Experience in the Use of Concrete Under Bridge Bed-plates and Turn-tables in Place of Pedestal Stones, and What is the Best Form and Material for Bed-plates Under Various Styles of Iron Bridges................................ — Walter A. Rogers, A. Minster, L. F. Goodale, E. H. R. Green, J. C. Hain, E. P. Hawkins.

THIRTEENTH CONVENTION, QUEBEC, CANADA, OCT. 20 TO 22, 1903

1.

What is the Best Form of Traveler to Use in Erecting Steel Railway Bridges of Spans up to 200 Feet.. — G. W. Smith, Moses Burpee, Geo. J. Bishop, A. O. Cunningham, J. C. Hain, J. F. Stern.

2.

What Has Been the Experience in Use of Concrete Under Bridge Bed-plates and Turn-tables in Place of Pedestal Stones, and What is the Best Form and Material for Bed-plates Under Various Styles of Iron Bridges (Continued from 1902).................. — C. F. Loweth, T. M. Strain, J. E. Johnson, A. Minster, D. W. Lum, J. P. Snow.

3.

Best Methods of Caring for Trestles While Being Filled.... .... — A. H. King, J. B. Sheldon, H. D. Cleaveland, A. J. Hart, F. Ingalls, J. S. Lemond.

4.

Best Forms of Construction for Engine Houses. ..... — A. W. Merrick, L. H. Wheaton, R. L. Heflin, C. W. Kelley, C. C. Mallard, A. B. Manning.

5.

Best Methods of Filling Ice Houses and Conveying Ice to Refrigerator Cars............................. — J. T. Carpenter, F. L. Burrell, John P. Canty, A. McNab, C. M. Large, G. Larson.

6.

Best Methods of Filling Track Water Tanks Automatically.. — E. B. Ashby, Willard Beaham, C. H. Miller, Thomas S. Leake, F. E. Schall, L. F. Price.

7.

Steam Hammers Versus Drop Hammers for Pile-drivers..	O. J. Travis, R. H. Reid, N. H. LaFountain, Frank J. Leavitt, G. O. Lilly, H. Rettinghouse.

8.

Best Form of Construction for Docks and Wharves..	John D. Isaacs, W. A. McGonagle, Henry Goldmark, G. J. Klump, R. B. Tweedy, G. F. Powers.

9.

Best Record Forms for Buildings, Water Tanks, etc.	B. J. Sweatt, B. F. Pickering, A. Shane, I. O. Walker, J. F. White, William E. Harwig.

10.

Best Freight and Roundhouse Doors, and Fittings for the Same..	John I. Banks, James McIntyre, R. K. Ross, Ed. Gilchrist, George W. Welker.

11.

Best Methods for Preserving Timber and Piles in Structures..	Wm. F. Steffens, John D. Isaacs, Geo. A. Mountain, E. Loughery, C. C. Witt, B. F. Bond.

12.

Best Methods of Protecting Low Overhead Structures Over Tracks from Gases and Blast of Locomotives..	B. W. Guppy, Grosvenor Aldrich, F. F. Lloyd, Robert J. Bruce, Wm. M. Clark, J. S. Berry.

FOURTEENTH CONVENTION, CHICAGO, ILL., OCTOBER 18 TO 20, 1904.

1.

Construction and Maintenance of Docks and Wharves.	H. Rettinghouse, W. A. McGonagle, A. A. Page, J. S. Browne, W. M. Noon, L. J. Anderson, L. D. Smith.

2.

Relative Value of Concrete and Timber Piles..........	W. H. Finley, J. C. Hain, W. A. Rogers, D. W. Lum, W. S. Dawley, L. F. Goodale.

3.

Concrete Building Construction, Including Platforms.	C. W. Richey, A. O. Cunningham, C. F. Loweth, G. A. Wright, F. P. Gutelius.

4.

Anchors for Plows and Derricks........................	R. J. Arey, A. J. Ross, E. Loughery, M. Bishop.

5.

Methods of Repairing Roofs of Various Kinds.........	J. N. Penwell, A. W. Merrick, G. C. Larson, H. W. Phillips, C. F. Flint, Floyd Ingram.

6.

Methods of Watering Stock in Transit.................	J. O. Thorn, B. J. Sweatt, F. O. Draper, F. Ingalls, F. L. Park.

7.

Protection of Water Tanks and Water Pipes from Action of Frost..	J. P. Canty, J. Parks, A. Findley, F. L. Burrell, K. J. C. Zinck.

8.

Recent Practice in Coffer Dam Work.................	W. F. Steffens, F. E. Schall, G. J. Klumpp, R. H. Reid, Wm. Kleefeld, Jr.

STANDING COMMITTEES.

1.	
Pile and Frame Trestle Bridges	F. S. Edinger, W. M. Clark, I. F. Stern, W. E. Alexander, J. C. Taylor.
2.	
Steel Bridges	H. H. Eggleston, J. P. Snow, C. H. Cartlidge, H. M. Trippe, J. W. Lantry.
3.	
Buildings	E. Du Bois Brown, W. A. Pettis, W. C. Halsey, T. S. Leake.
4.	
Docks and Wharves	R. Angst, W. J. Mellor, John I. Banks, K. S. Hull, A. McDonald.
5.	
Water Supply	B. M. Hudson, F. J. Leavitt, D. C. Zook, Chas. Carr, J. H. Howe.
6.	
Fire Protection	Geo. W. Andrews, R. A. Nickerson, Wm. H. Keen, H. A. Horning.
7.	
Fences, Crossings and Cattle Guards	C. S. Corrigan, C. F. King, J. S. Berry, Walter Hurst, Burton Marye.
8.	
Preservatives for Wood and Metals	F. D. Beal. J. F. Parker, E. Fisher, J. C. Beye, C. A. Thanheiser.
9.	
Coaling Stations and Cinder Pits	W. B. Causey, B. M. Drake, J. W. McCormack, Willard Beahm.
10.	
Records and Accounts	H. M. Henson, R. C. Sattley, Ed. Gagnon, E. R. Floren.

CONSTITUTION.

ARTICLE I.

NAME.

SECTION 1. This Association is known as the "Association of Railway Superintendents of Bridges and Buildings."

ARTICLE II.

OBJECT.

SECTION 1. The object of this Association shall be the mutual advancement of its members, by the acquirement of more perfect knowledge in the construction, maintenance, and repair of railroad bridges and buildings, as well as all other matters entrusted to the care of superintendents of bridges and buildings, by common discussion, interchange of ideas, reports, and investigations of its members.

ARTICLE III.

MEMBERSHIP.

SECTION 1. Any person at the head of a bridge and building department on any railroad, or a division or subdivision, and to include assistant superintendent and general foreman of any railroad, shall be eligible to membership in this Association upon application to the Secretary and the payment of $3.00 membership fee and $2.00 for one year's dues, membership to continue until written resignation is received by the Secretary, unless member has been previously expelled.

SEC. 2. Any member guilty of dishonorable conduct, or conduct unbecoming a railroad official and member of this Association, or who shall refuse to obey the chairman, or rules of this Association, may be expelled by a two-thirds vote of the members present.

SEC. 3. Any member elected a Life Member of this Association, shall have all of the privileges of an active member, but shall not be required to pay annual dues.

ARTICLE IV.

OFFICERS.

SECTION 1. The officers of this Association shall be a president, four vice-presidents, a secretary, a treasurer, and six executive members. The executive members, together with the president, secretary, and treasurer, shall constitute the Executive Committee.

All Past-Presidents of this Association, who continue to be members, shall be entitled to be present at all meetings of the Executive Committee, of which meetings they shall receive due notice, and be permitted to discuss all questions coming before the Executive Committee and to aid said committee by their advice and counsel; but, said Past-Presidents shall not have a right to vote, nor shall their presence be requisite in order to constitute a quorum.

ARTICLE V.

DUTIES OF OFFICERS.

SECTION 1. The duties of officers shall be such as prescribed by by-laws, as pertain to officers of like character, general, or may be assigned them by the Executive Committee.

ARTICLE VI.

EXECUTIVE COMMITTEE.

SECTION 1. The Executive Committee shall exercise a general supervision over the financial and other interests of the Association, assess the amount of annual and other dues, call, prepare for, and conduct general or special meetings, make all necessary purchases and contracts required to conduct the general business of the Association, but shall not have power to render the Association liable for any debt beyond the amount then in the treasurer's hands not subject to other prior liabilities. All appropriations for special purposes must be acted upon at a regular meeting of the Association.

SEC. 2. The Executive Committee shall report the proceedings of its meetings, making such reports accessible to members; it shall publish the proceedings of all meetings of the Association, subject to the approval of the Association.

SEC. 3. Two thirds of the members of the Executive Committee may call special meetings, sixty days' notice being given members by mail.

SEC. 4. Five members of the Executive Committee shall constitute a quorum for the transaction of business.

ARTICLE VII.

ELECTION OF OFFICERS AND TENURE OF OFFICE.

SECTION 1. The officers, excepting as otherwise provided, shall be elected at the regular meeting of the Association, held on third Tuesday in October of each year, and the election shall not be postponed except by unanimous consent.

PRESIDENT AND TREASURER.

SEC. 2. The president and treasurer shall be elected by ballot by a majority of votes cast, and shall hold office for one year, or until successors are elected.

VICE-PRESIDENTS AND EXECUTIVE MEMBERS.

SEC. 3. The vice-presidents shall hold office for one year and executive members for two years, four vice-presidents, and three executive members to be elected each year; provided, however, that three of the executive members be appointed by the president at the adoption of this constitution. All officers herein named to hold office until successors are chosen at next annual meeting.

SEC. 4. In the election of vice-presidents, each one shall be elected by a majority vote. Executive members will be elected in the same way. all voting to be by written ballots.

SECRETARY.

SEC. 5. A secretary shall be elected by a majority of the votes of the members present at the annual meeting. The term of office of the secretary shall be for one year, unless terminated sooner by action of the Executive Committee, two-thirds of whom may remove the secretary at any time. His compensation shall be fixed by a majority of the Executive Committee. The secretary shall also be secretary of the Executive Committee.

TREASURER.

SEC. 6. The treasurer shall be required to give bond in an amount to be fixed by the majority of the Executive Committee.

ARTICLE VIII.

COMMITTEES.

SECTION 1. At the first session of the annual meeting the president shall appoint a committee of three members, not then officers of the Association, who shall send names of nominees for officers of the Association for the ensuing year to the secretary, before the election of officers is in order, and the names shall be announced as soon as received. The election shall not be held until the day after announcement, except by unanimous consent. Nothing in this section shall be construed to prevent any members from making nominations.

AUDITING COMMITTEE.

SEC. 2. At the first session of each annual meeting there shall be appointed by the president an auditing committee of three members, not officers of the Association, whose duty it shall be to examine the accounts and vouchers of the treasurer and certify as to the correctness of his accounts. Acceptance of this committee's report will be regarded as the discharge of the committee.

COMMITTEES ON SUBJECTS FOR DISCUSSION.

SEC. 3. At the annual meeting there shall be appointed by the president a committee, whose duty it shall be to prepare and report subjects for discussion and investigation at the next annual meeting. If subjects are approved by the Association, the president shall appoint a committee to report on them. It shall be the duty of the committee to receive from members questions for discussion during the time set apart for that purpose. This committee shall be the judge of whether such questions are suitable ones for discussion, and if so, report them to the Association.

COMMITTEES ON INVESTIGATION.

SEC. 4. When the committee on subjects has reported and the Association approved of the same, the president shall appoint special committees to investigate and report on said subjects and he may appoint a special committee to investigate and report on any subject which a majority of members present may approve of.

ARTICLE IX.

ANNUAL DUES.

SECTION 1. Every member shall pay to the treasurer three dollars membership fee, and shall also pay two dollars per year in advance to defray the necessary expenses of the Association. No member being one year in arrears for dues will be entitled to vote at any election, and any member one year in arrears may be stricken from the list of members at the discretion of the Executive Committee.

ARTICLE X.

AMENDMENTS.

SECTION 1. This constitution may be amended at any regular meeting by a two-thirds vote of members present, provided that a written notice of the proposed amendment has been given at least ninety days previous to said regular meeting.

BY-LAWS.

TIME OF MEETING.

1. The regular meeting of this Association shall be held annually on the third Tuesday in October.

HOUR OF MEETING.

2. The regular hour of meeting shall be at 10 o'clock a. m.

PLACE OF MEETING.

3. The cities or places for holding the annual convention may be proposed at any regular meeting of the Association before the final adjournment. The places proposed shall be submitted to a ballot vote of the members of the Association, the city or place receiving a majority of all the votes cast to be declared the place of the next annual meeting; but if no place received a majority of all votes, then the place receiving the lowest number of votes shall be dropped on each subsequent ballot until a place is chosen.

QUORUM.

4. At the regular meeting of the Association, fifteen or more members shall constitute a quorum.

ORDER OF BUSINESS.

5. 1st—Calling of roll.
2d—Reading minutes of last meeting.
3d—Admission of new members.

4th—President's address.
5th—Reports of secretary and treasurer.
6th—Payment of annual dues.
7th—Appointment of committees.
8th—Reports of committees.
9th—Unfinished business.
10th—New business.
11th—Reading and discussion of questions propounded by members.
12th—Miscellaneous business.
13th—Election of officers.
14th—Adjournment.

DUTIES OF OFFICERS.

6. It shall be the duty of the president to call the meeting to order at the appointed time; to preside at all meetings; to announce the business before the Association, and to decide all questions of order and sign all orders drawn on the treasurer.

7. It shall be the duty of the vice-presidents, in the absence of the president, to preside at all meetings of the Association, in their order named.

8. It shall be the duty of the secretary to keep a correct record of proceedings of all meetings of this Association; to keep correct all accounts between this Association and its members; collect all moneys due the Association, and pay the same over to the treasurer and take his receipt therefor, and to perform such other duties as the Association may require.

9. It shall be the duty of the treasurer to receive and receipt to the secretary for all moneys received from him, and pay all orders authorized by the Association.

DECISIONS.

10. The votes of a majority of members present shall decide any question, motion, or resolution which shall be brought before the Association, unless otherwise provided.

DISCUSSIONS.

11. All discussions shall be governed by Roberts' Rules of Order.

DIRECTORY OF MEMBERS.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.

OCTOBER, 1904.

A

ALDRICH, GROSVENOR, N. Y., N. H. & H. R. R., Readville, Mass.

ALEXANDER, W. E., Bangor & Aroostook Railroad, Houlton, Me.

AMOS, ALEXANDER, Minn., St. P. & S. Ste. M. Ry., Minneapolis, Minn.

ANDERSON, J. W., Cin., Hamilton & Dayton Ry., Chillicothe, Ohio.

ANDERSON, L. J., C. & N. W. Ry., Escanaba, Mich.

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ANDREWS, O. H., St. Jo. & G. I. Ry., St. Joseph, Mo.

ANGST, R., Duluth & Iron Range R. R., Duluth, Minn.

AREY, RALPH J., A. T. & S. F. Ry. (Coast Lines), Williams, Arizona.

ASHBY, E. B., Engr. M. of W., L. V. R. R., So. Bethlehem, Pa.

AUSTIN, CYRUS P., Boston & Maine R. R., Medford, Mass.

B.

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Bell, W. E., Plant System, Thomasville, Ga.

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Berry, William, San Antonio & Aransas Pass Ry., Yoakum, Texas.

Beye, John C., Union Pacific R. R., Cor. 12th & Liberty Sts., Kansas City, Mo.

Bishop, George J., G. T. Ry., Durand, Mich.

Bishop, McClellan, C. R. I. & P. Ry., Okla. Div., Chickasha, I. T.

Biss, C. H., New Zealand Govt. Rys., Auckland, New Zealand.

Blake, Alex. C., Wabash R. R., Moberly, Mo.

Bond, B. F., Chief Engr. Jacksonville & St. Louis Ry., Jacksonville, Ill.

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Brown, Ebenezer, G. T. Ry., Allandale, Ont.

Browne, J. S., N. Y., N. H. & H. R. R., Providence, R. I.

Bruce, Robert J., P., C., C. & St. L. Ry., Logansport, Ind.

Burnett, James, Govt. Rys., Wellington, New Zealand.

Burpee, Moses, Chief Engr. Bangor & Aroostook R. R., Houlton, Me.

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C

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S

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T

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V

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Y

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Z

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DECEASED MEMBERS.

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DUNLAP, H., Wabash R. R., Andrews, Ind.

FULLER, C. E., T. H. & I. R. R., Terre Haute, Ind.

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McGEHEE, G. W., Mobile & Ohio Railroad Co., Okolona, Miss.

MILLINER, S. S., B. & O. S. W. Ry., Washington, Ind.

MITCHELL, J. B., C., C., C. & St. L. Ry., Indianapolis, Ind.

MITCHELL, W. B., N. Y., P. & O. R. R., Galion, Ohio.

PECK, R. M., Missouri Pac. & St. L., I. M. & S. Ry., Pacific, Mo.

REID, GEORGE M., L. S. & M. S. R. R., Cleveland, Ohio.

SPAFFORD, L. K., K. City, Fort Scott & Memphis Ry., Kansas City, Mo.

SPANGLER, J. A., B. & O. Ry., Washintgon, Pa.

TAYLOR, J. W., Terminal R. R. Association of St. Louis, St. Louis, Missouri.

THOMPSON, N. W., P., F. W. & C. Ry., Ft. Wayne, Ind.

TOZZER, WILLIAM S., C. & O. R. R., Cincinnati, Ohio.

TRAUTMAN, J. J., S. C. R. R., Edgefield, S. C.

WORDEN, C. G., S. F. Pac. R. R., Winslow, Ariz.

MEMBERSHIP AND MILEAGE OF RAILWAYS REPRESENTED IN THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.

Name of Road and Membership.	Members.	Mileage.
Atchison, Topeka & Santa Fé Railway..........	5	5,031
F. M. Clough, San Marcial, N. M.		
J. D. Gilbert, Topeka, Kan.		
E. A. McCann, Wellington, Kan.		
J. M. Wells, Chillicothe, Ill.		
M. R. Williams, Las Vegas, N. M.		
Atchison, Topeka & Santa Fé Railway (Coast Lines), ...	3	1,937
R. J. Arey, Williams, Ariz.		
E. E. Ball, Williams, Ariz.		
D. A. Shope, Winslow, Ariz.		
Atlanta & West Point Railroad, and Western Railway of Alabama	1	225
O. T. Nelson, Montgomery, Ala.		
Atlantic Coast Line (Plant System) Railroad	1	4,085
W. E. Bell, Thomasville, Ga.		
Baltimore & Ohio Railroad	7	4,410
G. W. Andrews, Baltimore, Md.		
W. M. Clark, Warren, O.		
William Graham, Baltimore, Md.		
J. E. Greiner, Baltimore, Md.		
V. K. Hendricks, Baltimore, Md.		
J. T. McIlwain, Akron, O.		
W. T. Schultz, Zanesville, O.		
Bangor & Aroostook Railroad	2	413
W. E. Alexander, Houlton, Me.		
M. Burpee, Houlton, Me.		
Barclay Railroad	1	14
C. H. Davis, New York City.		
Bessemer & Lake Erie Railroad	1	216
H. D. Cleaveland, Greenville, Pa.		

Boston & Maine Railroad	11	2,290
Cyrus P. Austin, Medford, Mass.		
C. C. Battey, Concord, N. H.		
J. P. Canty, Fitchburg, Mass.		
F. J. Leavitt, Sanbornville, N. H.		
William A. Lydston, Salem, Mass.		
Albert Mountfort, Nashua, N. H.		
A. A. Page, Boston, Mass.		
S. F. Patterson, Concord, N. H.		
B. F. Pickering, Sanbornville, N. H.		
J. P. Snow, Boston, Mass.		
E. C. Spaulding, St. Johnsbury, Vt.		
Buffalo, Rochester & Pittsburg Railway	1	475
E. J. Govern, Rochester, N. Y.		
Canada Atlantic Railway	1	468
George A. Mountain, Ottawa, Ont.		
Canadian Pacific Railway	5	8,183
Henry Goldmark, Montreal, P. Q.		
F. P. Gutelius, Montreal, P. Q.		
P. B. Motley, Montreal, P. Q.		
C. N. Mousarrat, Montreal, P. Q.		
W. F. Tye, Montreal, P. Q.		
Central Indiana Railway	1	128
H. H. Eggleston, Anderson, Ind.		
Central of Georgia Railway	2	1,869
H. C. McKee, Savannah, Ga.		
M. F. Tucker, Americus, Ga.		
Central Railroad of New Jersey	1	685
A. L. Bowman, New York City.		
Central Vermont Railway	3	531
C. F. Flint, St. Albans, Vt.		
H. E. Holmes, New London, Conn.		
G. J. Patterson, Waterbury, Vt.		
Chesapeake & Nashville Railway	1	48
H. M. Henson, Gallatin, Tenn.		
Chesapeake & Ohio Railway	2	1,670
J. M. Staten, Richmond, Va.		
C. W. Vandegrift, Alderson, W. Va.		
Chicago & Alton Railway	1	908
W. B. Causey, Bloomington, Ill.		

Chicago & Eastern Illinois Railroad	3	823
A. S. Markley, Danville, Ill.		
H. D. Perkins Villa Grove, Ill.		
G. A. Wright, Danville, Ill.		
Chicago & North Western Railway..............	31	7,363
L. J. Anderson, Escanaba, Mich.		
F. H. Bainbridge, Chicago, Ill.		
W. Beahan, Winona, Minn.		
F. L. Burrell, Fremont, Neb.		
Henry Crane (retired), Janesville, Wis.		
W. H. Finley, Chicago, Ill.		
H. W. Fletcher (Retired), Allegheny Pa.		
W. C. Halsey, Eagle Grove, Ia.		
John Hunciker, Chicago, Ill.		
C. W. Kelly, Boone, Ia.		
C. F. King, Norfolk, Neb.		
C. A. Lichty, Fond du Lac, Wis.		
George Loughnane, Mason City, Ia.		
A. W. Merrick, Boone, Ia.		
H. P. Morrill, Madison, Wis.		
R. A. Nickerson, Chicago, Ill.		
H. Rettinghouse, Kaukauna, Wis.		
E. F. Reynolds, Antigo, Wis.		
M. Riney, Baraboo, Wis.		
J. S. Robinson, Chicago, Ill.		
D. Rounseville, Kaukauna, Wis.		
R. C. Sattley, Chicago, Ill.		
I. F. Stern, Chicago, Ill.		
F. C. Stimson, Baraboo, Wis.		
B. J. Sweatt, Boone, Ia.		
W. J. Towne, Chicago, Ill.		
H. M. Trippe, Chicago, Ill.		
H. A. Walden, Boone, Ia.		
W. D. Walden (retired), Clinton, Ia.		
A. E. Winter, Chicago, Ill.		
C. C. Witt, Chicago, Ill.		
Chicago, Burlington & Quincy Railway and K. C., St. Jo. & C. B. Railway	5	8,738
C. H. Cartlidge, Chicago, Ill.		
E. M. Gilchrist, Centerville, Ia.		
L. F. Goodale, St. Louis, Mo.		
W. Hurst, St. Joseph, Mo.		
J. O. Thorn, Beardstown, Ill.		

Chicago Great Western Railway	3	1,321
L. P. Desilets, Des Moines, Ia.		
E. C. Macy, St. Paul, Minn.		
A. Munster, St. Paul, Minn.		
Chicago, Indianapolis & Louisville Railway	1	536
J. M. Caldwell, Lafayette, Ind.		
Chicago, Lake Shore & Eastern Railway	1	165
G. F. Powers, Joliet, Ill.		
Chicago, Milwaukee & St. Paul Railway	6	7,080
J. C. Hain, Chicago, Ill.		
A. J. Hart, Minneapolis, Minn.		
N. H. La Fountain, Chicago, Ill.		
C. F. Loweth, Chicago, Ill.		
W. E. Smith, Chicago, Ill.		
A. Yappen, Milwaukee, Wis.		
Chicago, Rock Island & Pacific Railway	6	6,836
McClellan Bishop, Chickasha, I. T.		
James Brady, Davenport, Ia.		
E. R. Floren, Fairbury, Neb.		
F. L. Park, Topeka, Kan.		
J. R. Pool, Little Rock, Ark.		
K. J. C. Zinck, Des Moines, Ia.		
Chicago, St. Paul, Minneapolis & Omaha Railway	3	1,676
G. Larson, Itasca, Wis.		
J. W. McCormack, Altoona, Wis.		
John Schwartz, Emerson, Neb.		
Chicago Terminal Transfer Railroad	1	259
E. N. Layfield, Chicago, Ill.		
Cincinnati, Hamilton & Dayton Railway	2	1,015
J. W. Anderson, Chillicothe, O.		
I. F. White, Hamilton, O.		
Cincinnati Northern Railroad	1	236
J. M. Wilkinson, Van Wert, O.		
Coast Railway of Nova Scotia, The, ...	1	
L. H. Wheaton, Yarmouth, N. S.		
Colorado & Southern Railway	1	1,121
W. T. Powell, Denver, Colo.		
Duluth & Iron Range Railroad	1	161
R. Angst, Duluth, Minn.		

Duluth, Missabe & Northern Railway	1	153
W. A. McGonagle, Duluth, Minn.		
Duluth, South Shore & Atlantic Railway	1	569
W. M. Noon, Marquette, Mich.		
Elgin, Joliet & Eastern Railway	2	221
A. Montzheimer, Joliet, Ill.		
M. D. Short, Joliet, Ill.		
El Paso Northeastern System	1	460
George C. Millet, Alamogordo, N. M.		
Erie Railroad (and Chicago & Erie)	4	2,423
W. O. Eggleston, Huntington, Ind.		
Neil McLean, Huntington, Ind.		
J. F. Pelham, Avon, N. Y.		
W. H. Wilkinson, Elmira, N. Y.		
Fort Worth & Denver City Railway	2	453
J. M. Mann, Fort Worth, Tex.		
O. J. Travis, Fort Worth, Tex.		
Galveston, Harrisburg & San Antonio Railway ..	4	917
C. S. Corrigan, San Antonio, Tex.		
C. R. Morrill, El Paso, Tex.		
A. J. Ross, El Paso, Tex.		
H. Small, San Antonio, Tex.		
Galveston, Houston & Northern Railway and Texas & New Orleans Railroad	2	498
A. McDonald, Houston, Tex.		
C. A. Thauheiser, Houston, Tex.		
Georgia Railroad	2	307
B. A. Guill, Camok, Ga.		
W. M. Robinson, Augusta, Ga.		
Grand Trunk Railway System	7	4,177
G. J. Bishop, Durand, Mich.		
Ebenezer Brown, Allandale, Ont.		
A. Findley, Montreal, P. Q.		
J. D. Lacy, Durand, Mich.		
George A. Mitchell, Toronto, Ont.		
A. E. Patton, Montreal, P. Q.		
R. K. Ross, Ionia, Mich.		
Gulf, Colorado & Sante Fé Railway	4	1,328
S. F. Clapp, Temple, Tex.		
K. S. Hull, Beaumont, Tex.		
T. H. Morgan, Cleburne, Tex.		
L. D. Smith, Galveston, Tex.		

Halifax & Southwestern Railway	1	96
I. H. White, Bridgewater, N. S.		
Illinois Central Railroad	7	4,296
F. O. Draper, Freeport, Ill.		
Thomas S. Leake, Chicago, Ill.		
G. O. Lilly, Carbondale, Ill.		
R. J. McKee, Clinton, Ill.		
William Reed, Jr., Fort Dodge, Ia.		
W. C. Waggoner, Central City, Ky.		
E. F. Wise, Waterloo, Ia.		
Intercolonial Railway	7	1,351
T. C. Burpee, Moncton, N. B.		
Hugh Jardine, Moncton, N. B.		
A. E. Killam, Moncton, N. B.		
H. I. McGrath, Moncton, N. B.		
W. B. McKenzie, Moncton, N. B.		
Thomas Sefton, Moncton, N. B.		
A. C. Selig, Moncton, N. B.		
Jacksonville & St. Louis Railway	1	121
B. F. Bond, Jacksonville, Ill.		
Lake Erie & Western Railway	1	719
J. N. Penwell, Tipton, Ind.		
Lake Shore & Michigan Southern Railway	1	1,416
R. H. Reid, Cleveland, O.		
Lehigh & Hudson River Railway	1	90
J. E. Barrett, Warwick, N. Y.		
Lehigh Valley Railroad	7	1,344
E. B. Ashby, South Bethlehem, Pa.		
Walter G. Berg, New York City.		
E. D. B. Brown, New York City.		
W. E. Harwig, Phillipsburg, N. J.		
R. L. Heflin, Sayre, Pa.		
David A. Keefe, Athens, Pa.		
F. E. Schall, South Bethlehem, Pa.		
Long Island Railroad	1	392
J. H. Cummin, Jamaica, N. Y.		
Louisville & Nashville Railroad	1	3,543
Floyd Ingram, Erin, Tenn.		
Maine Central Railroad	1	821
P. N. Watson, Brunswick, Me.		

Michigan Central Railroad	5	1,662
S. D. Bailey, Detroit, Mich.		
Charles Carr, Jackson, Mich.		
Thomas Hall, St. Thomas, Ont.		
Henry A. Horning, Niles, Mich.		
J. T. Webster, St. Thomas, Ont.		
Minneapolis & St. Louis Railroad	1	642
Ed. Gagnon, Minneapolis, Minn.		
Minneapolis, St. Paul & Sault Ste. Marie Railway	2	1,698
A. Amos, Minneapolis, Minn.		
P. Swenson, Minneapolis, Minn.		
Missouri Pacific Railway System	2	6,151
E. Fisher, Pacific, Mo.		
F. W. Tanner, Atchison, Kan.		
Mobile & Ohio Railroad	2	918
E. P. Hawkins, Okolona, Miss.		
C. A. Pigsford, Coden, Ala.		
Mobile & Bay Shore Railway (see Mobile & Ohio)		
Nashville, Chattanooga & St. Louis Railway	1	1,200
I. O. Walker, Paducah, Ky.		
New South Wales Government Railways	1	3,138
James Fraser, Sydney, N. S. W.		
New York Central & Hudson River Railroad	8	2,881
John I. Banks, New York City.		
William Kleefeld, Utica, N. Y.		
G. J. Klumpp, Rochester, N. Y.		
J. W. Lantry, Weehawken, N. J.		
R. P. Mills, Mott Haven, N. Y.		
W. A. Pettis, Rochester, N. Y.		
William F. Steffens, New York City.		
H. C. Thompson, Weehawken, N. J.		
New York, Chicago & St. Louis Railroad	1	523
James Rogers, Fort Wayne, Ind.		
New York, New Haven & Hartford Railroad	9	2,037
Grosvenor Aldrich, Readville, Mass.		
J. S. Browne, Providence, R. I.		
H. K. Higgins, Dorchester, Mass.		
William H. Keen, Hartford, Conn.		
H. W. Phillips, Braintree, Mass.		
L. H. Porter, Franklin, Mass.		
George T. Sampson, Boston, Mass.		
W. D. Sharpe, New London, Conn.		
J. B. Sheldon, Providence, R. I.		

New Zealand Government Railways	3	2,291
C. H. Biss, Auckland, New Zealand.		
James Burnett, Wellington, New Zealand.		
George C. Troup, Wellington, New Zealand.		
Northern Pacific Railway	6	5,305
James Hartley, Staples, Minn.		
N. F. Helmers, Staples, Minn.		
F. Ingalls, Jamestown, No. Dak.		
B. T. McIvers, St. Paul, Minn.		
J. C. Taylor, Glendive, Mont.		
Louis Yager, Minneapolis, Minn.		
Oregon Short Line Railroad	1	1,266
A. H. King, Salt Lake City, Utah.		
Pacific Coast Co., The, ...	1	143
H. W. Bassett, Seattle, Wash.		
Pennsylvania Lines West of Pittsburg	5	2,943
Robert J. Bruce, Logansport, Ind.		
S. Geary, Cambridge, O.		
C. M. Large, Jamestown, Pa.		
A. F. Miller, Chicago, Ill.		
D. C. Zook, Fort Wayne, Ind.		
Pennsylvania Railroad	1	5,165
C. W. Richey, Allegheny, Pa.		
Pere Marquette Railroad	2	2,108
G. E. Hanks, Saginaw, Mich.		
A. McNab, Holland, Mich.		
Philadelphia & Reading Railway	2	1,468
John Foreman (Retired), Pottstown, Pa.		
W. W. Perry, Williamsport, Pa.		
Pittsburg & Lake Erie Railroad	2	191
D. L. McKee, McKee's Rocks, Pa.		
G. H. Soles, Pittsburg, Pa.		
Portland & Rumford Falls Railway	1	68
C. S. Osgood, Rumford Falls, Me.		
Quebec & Lake St. John Railway	1	241
A. E. Doucet, Quebec, Que.		
Rutland Railroad	1	416
J. E. Johnson, Rutland, Vt.		
St. Joseph & Grand Island Railway	1	313
O. H. Andrews, St. Joseph, Mo.		

St. Louis, Brownsville & Mexico Railroad	1	141
Frank G. Jonah, Corpus Christi, Tex.		
St. Louis & San Francisco Railroad	2	4,748
W. S. Dawley, Chicago, Ill.		
Samuel Boutin, Cape Girardeau, Mo.		
St. Louis, Kansas City & Colorado Railroad	1	262
B. M. Hudson, Union, Mo.		
St. Louis Southwestern Railway	1	1,309
J. S. Berry, Tyler, Tex.		
San Antonio & Aransas Pass Railway	1	724
William Berry, Yoakum, Tex.		
Sonora Railway	2	265
J. S. Bright, Guaymas, Mex.		
S. Munstain, Carbo, Mex.		
Southern Railway	8	7,158
James T. Carpenter, Princeton, Ind.		
William A. Fort, Columbia, S. C.		
O. D. Killebrew, Columbia, S. C.		
J. S. Lemond, Atlanta, Ga.		
D. W. Lum, Washington, D. C.		
B. Marye, Richmond, Va.		
J. W. Morgan, Columbia, S. C.		
G. W. Welker, Alexandria, Va.		
Southern California Railway	1	499
J. F. Parker, San Bernardino, Cal.		
Southern Pacific Company	9	5,863
F. D. Beal, West Oakland, Cal.		
R. M. Drake, San Francisco, Cal.		
F. S. Edinger, San Francisco, Cal.		
Thomas Humphreys, Bakersfield, Cal.		
F. W. Lloyd, Oakland Pier, Cal.		
C. C. Mallard, Lafayette, La.		
W. J. Mellor, Algiers, La.		
George W. Rear, San Francisco, Cal.		
Daniel Robertson, West Oakland, Cal.		
Temiskaming & Northern Ontario Railway	1	212
W. B. Russell, North Bay, Ont.		
Texas & New Orleans Railroad and Galveston Houston & Northern Railway	1	498
A. McDonald, Houston, Tex.		

Texas & Pacific Railway E. Loughery, Marshall, Tex.	1	1,833
Texas Midland Railroad E. H. R. Green, Terrell, Tex.	1	125
Toledo, Peoria & Western Railway J. H. Markley, Peoria, Ill.	1	248
Toledo, St. Louis & Western Railroad A. Shane, Frankfort, Ind.	1	450
Union Pacific Railroad J. C. Beye, Kansas City, Mo. J. H. Howe, Omaha, Neb. J. L. Neff, Omaha, Neb. J. Parks, Denver, Colo.	4	2,956
Wabash Railroad A. C. Blake, Moberly, Mo. A. O. Cunningham, St. Louis, Mo. William S. Danes, Peru, Ind. James Stannard, Moberly, Mo.	4	2,516
Wellington & Manawata Railway (New Zealand) Arthur Williams, Wellington, New Zealand.	1	84
Western Australia Government Railways W. J. George, Perth, Western Australia. E. S. Hume, Fremantle, Western Australia.	2	1,516
Miscellaneous	16	
Total	293	170,786

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DISCUSSIONS OF COMMITTEE REPORTS ON INVESTIGATION FOR 1902-1903.

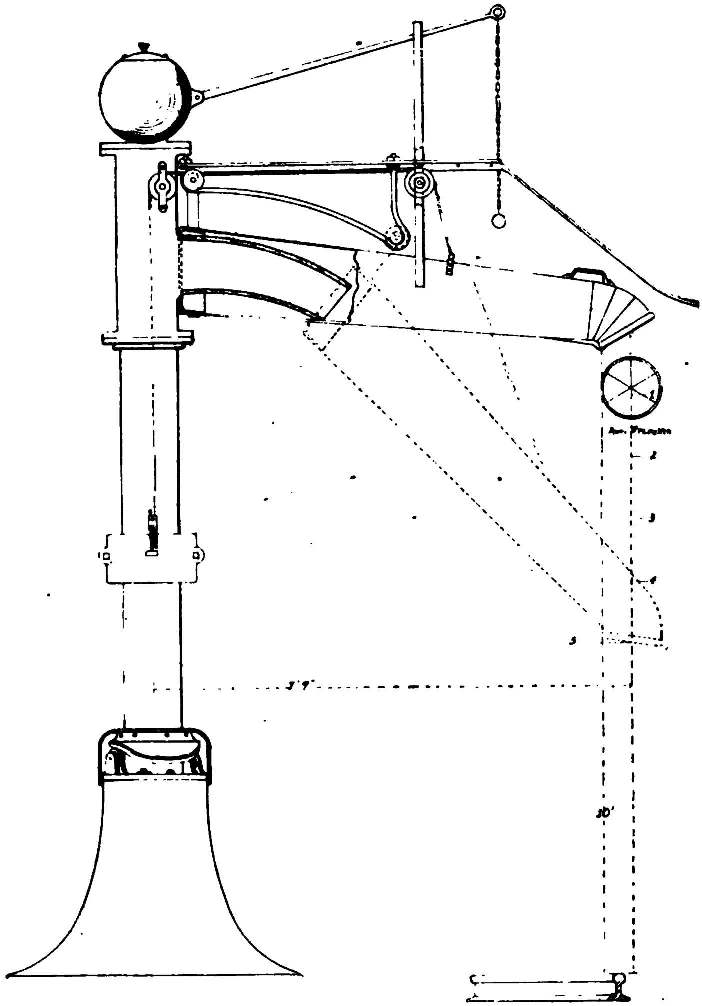
(For Reports, see last year's Proceedings.)

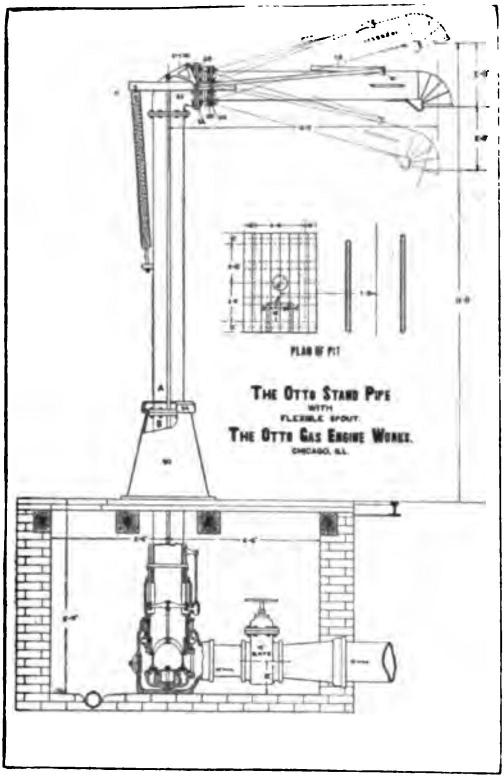
REPORTS OF COMMITTEES ON INVESTIGATION, 1903-1904.

COMMITTEES ON SUBJECTS FOR REPORT AND DISCUSSION.

LIST OF ILLUSTRATIONS.

INDEX TO ADVERTISEMENTS.




PLAN OF PIT
THE OTTO STAND PIPE
WITH
FLEXIBLE SPOUT.
THE OTTO GAS ENGINE WORKS.
CHICAGO, ILL.

MONON TRESTLE, PAOLI, INDIANA.

We have passed through a tremendously progressive period. We have seen the old give way to the new to meet the demand for something better

TWENTY-ONE YEARS

ago the first order for

PERFECTED GRANITE ROOFING

was sold to a railroad. It was a very small order. To-day that same railroad, one of the most prosperous and progressive in the United States, is one of our largest customers. Sales for 1904 to railroads were the largest ever. Moral—Till something better comes along Perfected Granite Roofing stays in commission. Proven to be the best of all prepared roofing, less costly and far more durable than tin, iron, slate or shingles, and more sightly.

EASTERN GRANITE ROOFING CO.
1 Hudson Street, New York

PROCEEDINGS

OF THE

Fifteenth Annual Convention

OF THE

Association of Railway Superintendents of Bridges and Buildings

HELD IN

PITTSBURG, PA.

October 17, 18 and 19, 1905

CONCORD, N. H.
RUMFORD PRINTING CO.
1905

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1905

OFFICERS FOR 1905-1906.

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Toledo, Peoria & Western Railway, Peoria, Ill.

R. H. REID . . . . . . SECOND VICE-PRESIDENT.
Lake Short & Michigan Southern Railway, Cleveland, Ohio.

R. C. SATTLEY . . . . . . THIRD VICE-PRESIDENT.
Chicago & North Western Railway, Chicago, Ill.

J. P. CANTY . . . . . . FOURTH VICE-PRESIDENT.
Boston & Maine Railroad, Fitchburg, Mass.

S. F. PATTERSON . . . . SECRETARY.
Boston & Maine Railroad, Concord, N. H.

C. P. AUSTIN . . . . TREASURER.
Boston & Maine Railroad, Medford, Mass.

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Wisconsin Central Railroad.

A. E. KILLAM . . . . Moncton, N. B.
Intercolonial Railway.

J. S. LEMOND . . . . Atlanta, Ga.
Southern Railway.

C. W. RICHEY . . . . Pittsburg, Pa.
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Chicago & Alton Railroad.

F. E. SCHALL . . . . South Bethlehem, Pa.
Lehigh Valley Railroad.

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O. J. TRAVIS . . . . . . Fort Worth, Tex.
Fort Worth & Denver City Railway.

*H. M. HALL . . . . Olney, Ill.
Ohio & Mississippi Railway.

*J. E. WALLACE . . . . Springfield, Ill.
Wabash Railroad.

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Baltimore & Ohio Railroad.

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Duluth, Massabe & Northern Railway.

JAMES STANNARD . . . . Moberly, Mo.
Wabash Railroad.

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Lehigh Valley Railroad.

J. H. CUMMIN . . . . Jamaica, N. Y.
Long Island Railroad.

AARON S. MARKLEY . . . . Danville, Ill.
Chicago & Eastern Illinois Railroad.

WALTER A. ROGERS . . . 355 Dearborn St., Chicago, Ill.

WILLIAM S. DANES . . . . Peru, Ind.
Wabash Railroad.

B. F. PICKERING . . . . Sanbornville, N. H.
Boston & Maine Railroad.

ARTHUR MONTZHEIMER . . . . Joliet, Ill.
Elgin, Joliet & Eastern Railway.

C. A. LICHTY . . . . Fond du Lac, Wis.
Chicago & North Western Railway

*Deceased.

COMMITTEES FOR 1905-1906.

COMMITTEES ON SUBJECTS FOR REPORT AND DISCUSSION.

I. Concrete Bridges, Arches and Subways.

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R. H. Reid, L. S. & M. S. Ry., Cleveland, Ohio.
G. E. Hanks, Pere Marquette Ry., Saginaw, Mich.
A. S. Markley, C. & E. I. Ry., Danville, Ill.
H. D. Cleaveland, Bessemer & L. E. Ry., Greenville, Pa.
M. Burpee, Bangor & Aroostook R. R., Houlton, Me.

II. Experience and Use of Concrete and Timber Piles.

W. H. Finley, C. E., 554-6 Monadnock Block, Chicago, Ill., Chairman.
E. N. Layfield, Chicago Terminal Transfer Ry., 353 Grand Central Station, Chicago, Ill.
W. S. Dawley, Frisco System, Chicago, Ill.
L. D. Smith, Gulf, Colorado & Santa Fé Ry., Galveston, Tex.

III. Concrete Building Construction.

C. W. Richey, Master Carpenter, Penn. Lines, Room 217, Union Station, Pittsburg, Pa., Chairman.
W. W. Perry, P. & R. Ry., Williamsport, Pa.
Charles Carr, Michigan Central Ry., Jackson, Mich.
R. P. Mills, N. Y. C. & H. R. R. R., 135th St., Mott Haven, N. Y.
W. B. Yearance, C. E., 418 Center St., South Orange, N. J.
R. L. Heflin, L. V. Ry., Sayre, Pa,

IV. Method of Watering Stock in Transit.

J. N. Penwell, L. E. & W. Ry., Tipton, Ind., Chairman.
U. A. Horn, Mo. Pacific Ry., Osawatomie, Kan.
M. R. Williams, Atch., Topeka & Santa Fé Ry., Las Vegas, N. M.
C. F. King, C. & N. W. Ry., Norfolk, Neb.
G. F. Powers, E., J. & E. Ry., Joliet, Ill.
J. C. Taylor, Northern Pacific Ry., Glendive, Mont.

V. Recent Practice in Coffer Dam Work.

W. F. Steffens, South & West Ry., Bristol, Va., Chairman.
G. Aldrich, N. Y., N. H. & H. R. R., Readville, Mass.
W. A. Fort, Southern Ry., Columbia, S. C.
E. P. Hawkins, Mobile & Ohio Ry., Okolona, Miss.

VI. Modern Coaling Stations and Cinder Pits.

J. S. Browne, N. Y., N. H. & H. R. R., Providence, R. I., Chairman.
F. B. Scheetz, Mo. Pacific Ry., St. Louis, Mo.
D. W. Lum, Southern Ry., Washington, D. C.
G. H. Soles, P. & L. E. Ry., Pittsburg, Pa.
F. P. Gutelius, C. P. R. R., Montreal, P. Q.

VII. Bumping Blocks for Passenger and Freight Use.

A. E. Killam, I. C. Ry., Moncton, N. B., Chairman.
Thos. S. Leake, Ill. Central Ry., Chicago, Ill.
F. L. Burrell, C. & N. W. Ry., Fremont, Neb.
J. M. Staten, Chesapeake & Ohio Ry., Richmond, Va.
A. B. Hubbard, Boston & Maine R. R., Boston, Mass.

COMMITTEES ON STANDING SUBJECTS.

1. Pile and Frame Trestle Bridges.

J. P. Canty, Boston & Maine R. R., Fitchburg, Mass., Chairman.
K. S. Hull, Gulf, Colorado & Santa Fé Ry., Beaumont, Tex.
J. E. Johnson, Rutland Ry., Rutland, Vt.
W. O. Eggleston, Erie Ry., Huntington, Ind.
H. F. Morrill, C. & N. W. Ry., Madison, Wis.

2. Steel Bridges.

A. O. Cunningham, Wabash R. R., St. Louis, Mo., Chairman.
W. H. Wilkinson, Erie Ry., Elmira, N. Y.
J. P. Snow, Boston & Maine R. R., Boston, Mass.
W. M. Kleefield, N. Y. C. & H. R. R. R., Utica, N. Y.
F. E. Schall, L. V. Ry., South Bethlehem, Pa.

3. Buildings.

W. B. Causey, C. & A. R. R., Bloomington, Ill., Chairman.
F. Ingram, L. & N. Ry., Erin, Tenn.
Walter Hurst, C., B. & Q. Ry., St. Joseph, Mo.
J. M. Caldwell, C. I. & L. Ry., Lafayette, Ind.

4. Water Supply.

B. M. Hudson, St. L., K. C. & Col. Ry., Union, Mo., Chairman.
H. Rettinghouse, Wis. Central Ry., Fond du Lac, Wis.
M. Riney, C. & N. W. Ry., Baraboo, Wis.
J. L. Talbott, A., T. & S. F. Ry., Pueblo, Col.
M. Bishop, C., R. I. & Pacific Ry., Chickasha, I. T.

5. Fire Protection.

Geo. W. Andrews, B. & O. Ry., Baltimore, Md., Chairman.
R. A. Nickerson, C. & N. W. Ry., Chicago, Ill.
W. H. Keene, N. Y., N. H. & H. R. R., Hartford, Conn.
D. C. Zook, Penn. Lines West of Pittsburg, Fort Wayne, Ind.

6. Fences, Road Crossings and Cattle Guards.

A. Findley, G. T. Ry., Montreal, P. Q., Chairman.
J. Hartley, Northern Pacific, Staples, Minn.
A. McDonald, Texas & New Orleans Ry., Houston, Tex.
Geo. J. Patterson, C. V. Ry., Waterbury, Vt.
M. F. Tucker, Central of Ga. Ry., Americus, Ga.

7. Preservatives for Wood and Metals.

F. D. Beal, Southern Pacific Ry., West Oakland, Cal., Chairman.
R. J. Arey, A., T. & S. F. Ry., Williams, Ariz.
H. Small, Galveston, Harrisburg & San Antonio Ry., San Antonio, Tex.
W. A. McGonagle, Duluth, Missabe & Northern Ry., Duluth, Minn.

8. Records and Accounts.

R. C. Sattley, Div. Engr., C. & N. W. Ry., Winona, Minn., Chairman.
J. S. Lemond, Southern Ry., Atlanta, Ga.
James Stannard, Wabash, Ry., Moberly, Mo.
J. C. Beye, Union Pacific, Kansas City, Mo.

COMMITTEE ON SELECTION OF SUBJECTS.

W. G. Berg, L. V. Ry., New York, N. Y.
J. H. Cummin, Long Island Ry., Jamaica, N. Y.
W. M. Clark, B. & O. Ry., Youngstown, Ohio.

COMMITTEE ON APPLICATION FOR MEMBERSHIP.

C. A. Lichty, C. & N. W. Ry., Fond du Lac, Wis., Chairman.
A. A. Page, Boston & Maine R. R., Boston, Mass.

COMMITTEE ON ENTERTAINMENT.

B. F. Pickering, B. & M. R. R., Sanbornville, N. H., Chairman.
J. P. Snow, B. & M. R. R., Boston, Mass.
G. T. Sampson, N. Y., N. H. & H. R. R., South Station, Boston, Mass.

COMMITTEE ON RELIEF.

A. Montzheimer, E., J. & E. Ry., Joliet, Ill., Chairman.
J. W. Morgan, Southern Ry., Columbia, S. C.
W. A. Rogers, C. E., Ellsworth Bldg., 355 Dearborn St., Chicago, Ill.

COMMITTEE ON MEMOIRS.

H. W. Fletcher, 366 California Ave., Allegheny, Pa.

Proceedings of the Fifteenth Annual Convention

OF THE

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS,

HELD IN PITTSBURG, PA., OCTOBER 17, 18 AND 19, 1905.

MORNING SESSION.

TUESDAY, October 17, 1905.

The Convention was called to order by the president, Mr. C. A. Lichty, at 10.45 o'clock a. m. Tuesday, October 17, 1905, in the Assembly Hall of the Monongahela House at Pittsburg, Pa.

President.—Ladies and Gentlemen: The time has come for the opening of our Convention. Please all rise while we open with prayer.

Prayer was then offered by Mr. J. H. Cummin of the Long Island Railroad.

President.—We are now likened unto those who stand at the door and knock. We stand without the gates of the City of Pittsburg; we will now listen to the address of welcome by Mr. W. B. Rodgers, city solicitor.

Mr. Rodgers.—Mr. President, Ladies and Gentlemen: At the request of the mayor of this city and by his direction, I welcome the members of this Association and the ladies who are present here, to the City of Pittsburg, and I want to make that welcome just as cordial as I can, because we appreciate very much the presence among us of a body of men who have so much to do with the development of this country and with the comfort and safety of the traveler. You will find in this city a great many objects which will be of partic-

ular interest to those who are engaged in the technical lines with which you are connected. Pittsburg has sometimes been called the Birmingham of America, and I think that today Pittsburg equals, if not excels, the English Birmingham, because I think Pittsburg today occupies a more commanding position, as respects the iron and steel trade, than the English Birmingham does.

We have a very wide field in those industries here in Pittsburg and Allegheny County. We have a great army of working men, who, in the midst of fire, heat and sparks, give form and shape to molten iron and steel; and here we have great buildings and bridges and works, the result of the labor and skill of the workmen, which stand as a monument to the men who made the parts and to the men who designed and executed the work, because without the thought and the study and the intellect of the men who designed, the men who executed and the men who cared for these works, the different parts would be like senseless masses of metal.

There are more objects here that will be of interest to you than I know anything about, and if you, with your peculiar tastes. have the time to pay some attention to these things, you will soon come to know more about these bridges and these structures than the great mass of the people of this community know today.

That is very natural, and I believe I can illustrate that best by a story that I read sometime ago. There was an American over at Newcastle-on-Tyne, and whenever I think of Newcastle-on-Tyne I think of Stevenson and his great bridge at that place. The American was interested in a great many objects there and he was particularly interested in an old castle. The foundations of that castle had been built by the Romans. The American in speaking of the castle to an Englishman who had lived all his life at Newcastle-on-Tyne found that the Englishman was not taking a great deal of interest in it—did not seem to appreciate what he was saying—and finally the Englishman said to him, "I have never been in that castle." The American

asked him how many years he had lived there and he replied 40 years. The American said, "Why, I am astonished that you have never been inside of that castle. It is a most astonishing thing to me." The Englishman said to him, "Where do you come from in America?" and the American said, "I came from Chicago." The Englishman said to him, "Were you ever in the Chicago stockyards?" and the American said, "No." The Englishman said, "Well, I have been." So you will know more about these interesting objects than we know. And it is a good thing that you have a feeling of interest in objects in a strange city, because that distributes knowledge all over the country, from one place to another. Before speaking I did not intend to say anything, but I want to say one thing now, and it has nothing to do with the speech of welcome, and that is I was much affected when you opened your deliberations with prayer. I have addressed many associations that have met here in Pittsburg and I never saw a meeting opened that way before. It seemed delightful to me and it brought back the old days.

It is with a very sincere feeling that I welcome the members of this Association and, as I said before, we appreciate very much your presence. In looking over the proceedings of your last Convention I thought that your work was not only very important, but very interesting, and I bid you welcome to this city and hope that your stay here will be pleasant and profitable. I haven't any jokes, because I look on life as being rather serious, and your work is serious and important work, and I can only join in the prayer that was made, that when you lay down your tools and quit the labors of this world you will gather together where there will be no more work and where, in peace and quiet, you will earn the rewards of a life well spent. (Applause.)

President.—I would like to have Mr. Cummin respond.

Mr. Cummin.—Mr. Rodgers, while you were addressing the Association and giving us such a cordial welcome, I noticed our president casting eyes over at me several times

and I thought of the little girl who, one evening when about ready to retire, said to her mother, "Mother, I wish you would not make me say such long prayers when I am so tired and sleepy. Why do n't you let me say short prayers, as nurse does?" Her mother looked at her in amazement and said, "Why, what does nurse say?" and the little girl replied, "Why, every morning when the bell rings to rise, she rolls over and says, 'O Lord, must I get up?'" I feel that I am in the position of a Methodist minister in a little village on Long Island, where I came from. There were two churches, one a Presbyterian, the other a Methodist. The Presbyterian minister wrote every word of his sermons and then read every word, while the Methodist brother did the opposite. The Methodist minister met him one day and took him to task about it. Said he, "Brother, you are making the mistake of your life. Every time you sit down to write your sermons the devil looks over your shoulder and reads every word and knows what you are going to say and he goes out and fortifies your congregation against you, so that your sermons do not do any good. With me it is different. I never write a word. I go to church Sunday morning and go through the opening exercises, get up and read my text, start in and the devil himself do n't know what I am going to say." (Applause.) That is about my situation now. I want to thank you, however, Mr. Rodgers, for the cordial greeting you have given our Association to this city. We have met here to do certain work that has been laid out for us during the past year. Committees have been appointed on different subjects and they are now ready to report, and we are ready to discuss those reports. In looking over the programme laid out by the Entertainment Committee, it might seem that after we had been here a few days, that the rest of the week would be devoted to pleasure, but on looking closely at that programme, you will find that the committee have done a wise thing. They have arranged all those trips in such a manner, that there will be certain objects for us to see and examine, and

there is no doubt in my mind that those things will be more important to us as members of this Association than even the proceedings of our meeting itself. I know of no place in this country where the members of this Association could meet with more benefit to themselves than in this City of Pittsburg. In a place with the industries you have mentioned in your remarks, I have no doubt there is not a member of this Association but will return to his home better fortified in every respect to continue the duties of his position by visiting here. I thank you, sir, for your cordial welcome. (Applause.)

President.—Next in order is roll-call. We will omit this order of business and each member is requested to register on the cards which we have here. The white cards are for members and the pink ones for visitors. Please be particular to register before leaving the Convention, so that we will have a complete list of those in attendance.

MEMBERS PRESENT.

ALDRICH, GROSVENOR, N. Y., N. H. & H. R. R., Readville, Mass.
ANDERSON, L. J., C. & N. W. Ry., Escanaba, Mich.
BURRELL, F. L., C. & N. W. Ry., Fremont, Neb.
CANTY, JOHN P., Fitchburg Div., B. & M. R. R., Fitchburg, Mass.
CLARK, WM. M., B. & O. R. R., Youngstown, Ohio.
CLEAVELAND, H. D., Bessemer & Lake Erie R. R., Greenville, Pa.
CUMMIN, JOSEPH H., Long Island R. R., Jamaica, N. Y.
CUNNINGHAM, O. H., Bridge Engr., Wabash R. R., St. Louis, Mo.
EGGLESTON, H. H., C. & A. Ry., Bloomington, Ill.
EGGLESTON, WILLIAM O., Erie R. R., Huntington, Ind.
GEARY, SYLVESTER, Penn. Lines W. of Pitts., Cambridge, Ohio.
GOVERN, EDW. J., Buffalo, Rochester & Pittsburg Ry., Rochester, N. Y.
HEFLIN, R. L., Lehigh Valley R. R., Sayre, Pa.
HUDSON, BEN M., St. L., K. C. & C. R. R., Union, Mo.
KEEN, WM. H., N. Y., N. H. & H. R. R., Hartford, Conn.
KILLAM, A. E., Intercolonial Ry., Moncton, N. B.
LARGE, C. M., Penn. Lines W. of Pitts., Jamestown, Pa.
LEMOND, J. S., Southern Ry., Atlanta, Ga.
LICHTY, C. A., C. & N. W. Ry., Fond du Lac., Wis.
MARKLEY, JOHN H., Toledo, Peoria & Western Ry., Peoria, Ill.
McINTYRE, JAMES, Miami, Fla.

McKee, D. L., Pittsburg & Lake Erie R. R., McKee's Rocks, Pa.
McLean, Neil, Erie R. R., Huntington, Ind.
Montzheimer, Arthur, Chief Engr., E., J. & E. Ry., Joliet, Ill.
Morrill, H. P., C. & N. W. Ry., Madison, Wis.
Noon, W. M., Duluth, South Shore & Atlantic Ry., Marquette, Mich.
Osgood, Cleon S., Portland & Rumford Falls Ry., Rumford Falls, Me.
Page, Adna A., Boston & Maine R. R., Boston, Mass.
Patterson, Samuel F., Boston & Maine R. R., Concord, N. H.
Penwell, John N., L. E. & W. Ry., Tipton, Ind.
Perry, W. W., Phila. & Reading Ry., 147 Market St., Williamsport, Pa.
Phillips, Henry W., N. Y., N. H. & H. R. R., So. Braintree, Mass.
Pickering, B. F., Boston & Maine R. R., Sanbornville, N. H.
Porter, L. H., N. Y., N. H. & H. R. R., Franklin, Mass.
Powers, George F., C., L. S. & E. Ry., South Chicago, Ill.
Reid, R. H., L. S. & M. S. Ry., Cleveland, Ohio.
Rettinghouse, H., Wis. Cent. Ry., Fond du Lac, Wis.
Richey, C. W., West Penn. Div. P. R. R., Box 28, Allegheny, Pa.
Schall, Frederick E., Bridge Engr., Lehigh Valley R. R., South Bethlehem, Pa.
Sheldon, J. B., New York, New Haven & Hartford R. R., Providence, R. I.
Soles, G. H., Pitts. & L. E. R. R., Pittsburg, Pa.
Staten, Joseph M., Chesapeake & Ohio Ry., Richmond, Va.
Steffens, Wm. F., Asst. Engr., M. W. Dept., N. Y. C. & H. R. R. R.
Tanner, Frank W., Mo. Pac. Ry., Atchison, Kan.
Vandergrift, C. W., C. & O. Ry., Huntington Div., Ronceverte, W. Va.
Wells, J. M., A. T. & S. F. Ry., Chillicothe, Ill.
Wilkinson, W. H., Erie R. R., Elmira, N. Y.
Winter, A. E., C. & N. W. Ry., No. 1 W. Kinzie St., Chicago, Ill.
Wise, E. F., Ill. Central R. R., Waterloo, Ia.

LIFE MEMBERS.

Fletcher, Holland W., 366 California Ave., Allegheny, Pa.
Foreman, John, Phila. & Read. R. R., Pottstown, Pa.

The following applicants for membership, subsequently elected, were also present:

Brown, J. B., Gen. Foreman, K. C., C. & S. Ry., Clinton, Mo.
Carson, D. J., B. R. & P. Ry., Du Boise, Pa.
Hansgen, Wm., Mo. Pac. R. R., Pacific, Mo.
Horn, U. A., Mo. Pac. R. R., Osawatomie, Kan.

Hubbard, Andrew B., B. & M. R. R., Boston, Mass.
Jutton, Lee, C. & N. W. Ry., Chicago, Ill.
McKibbon, Robert, P. R. R., Dravosburg, Pa.
Potts, J. O., Mo. Pac. R. R., St. Louis, Mo.
Sheetz, F. B., Mo. Pac. R. R., St. Louis, Mo.
Wackerle, L. J., Mo. Pac. R. R., Osawatomie, Kan.
Zinsmeister, E. C., B. & O. R. R., Zanesville, Ohio.

President.—The next order of business will be the reading of the minutes of the last Annual Convention, held at Chicago one year ago.

Mr. Cummin.—Inasmuch as the minutes have been published for some months and have been in the hands of the members, I move that the reading of the minutes be dispensed with.

Mr. Montzheimer.—I second that motion.

President.—It has been regularly moved and seconded that the reading of the minutes be dispensed with. All in favor of the motion please signify by saying "Aye." Those to the contrary, "Nay." The motion prevails.

President.—Admission of new members is next in order. I think, perhaps, we had better have a little intermission for that purpose, to secure the names of these applications and have the committee sign them; also, for the payment of the annual dues.

Mr. Cummin.—I think while we take an intermission for the payment of the dues, etc., that it would be well to distribute the ladies' badges and allow the ladies to retire, should they wish to do so.

President.—Yes, sir; that is a good suggestion. We will do so.

Mr. Cummin.—I would suggest that we have the president's address before taking that intermission.

President.—Before the intermission is taken we will have the president's address, which will be short.

President.—Ladies and Gentlemen and Members of the Association: I am sure that it is with feelings of happiness that we meet today in this great smoky City of Pittsburg, which is the heart of the manufacturing center of the world,

to celebrate the fifteenth annual meeting of our Association. The aims and purposes of this body are so well known to the railroad world that it will not be necessary to dwell upon them here. I notice before me this morning the faces of some of the charter members of this society, who met in St. Louis in 1891 and who formulated the beginning and laid the foundation of this, one of the foremost associations of its kind in this country. During the past year we had 297 members, representing over 170,000 miles of railways in the United States, Canada, Mexico, New Zealand and Australia. The history of the railroads of this country is, in many ways, unlike any history ever written. It must be admitted that the railroad is and has been the most potent factor in the rapid development of this broad nation—the greatest nation the world has ever seen, and it is recognized as one of the most powerful instruments of civilization throughout the world. Nearly every branch of railroading at the present time is represented by an association similar to this, for the study of every phase of the work within its scope, to bring out and discuss each and every detail and standardize practice as much as possible. Verily, does the railroad man of today lead a strenuous life. His work is never done. If he is transferred or his labors are ended, the work is taken up by another and carried on and on. His duties are in many instances of a varied nature. Especially is it so of the man who has charge of bridge and building work.

Mr. Onward Bates, ex-Chief Engineer of the C. M. & St. P. Ry., and a member of this Association, once said before a body of engineering students of the State University of Wisconsin at Madison: "Sometimes I think that the bridge and building department of a railway should be better called the miscellaneous department, because it has charge of all the odds and ends of mechanical work that do not belong anywhere else. Anything that is not strictly rolling-stock work or track work, or in some cases signal work, falls to the bridge and building department and, after

a superintendent has had a long experience, he is often called upon to do some particular work that is without precedent."

Then, again, many of the problems connected with maintenance vary with the climate and other conditions. The problems of a cold climate vary greatly from those of a tropical climate. The same can be said of thickly settled districts as compared with those which are sparsely settled. Likewise, the mountainous country as compared with that of the plain.

But wherever we may travel on these great avenues of commerce and civilization, regardless of country or clime, we see the evidences of the handiwork of our brothers. Many of them have erected huge monuments without a single inscription, which may outlive them here, perhaps for ages. But if they be faithful unto the end there shall be laid up for them a crown for their reward. There shall be written an epitaph which shall outlive time and memory.

I am glad to see so many of the old members present and welcome those of you who are new. We hope you may all find in these meetings both profit and pleasure. Let us then take up the work which is before us with renewed energy and when done try and enjoy ourselves as much as possible.

Before closing, gentlemen, I wish to thank you kindly for the honor which you have conferred upon me, by electing me to the highest position within your power. I appreciate this deeply and hope I may be able to do more for the good of this Association in the future than I have done in the past.

I cannot refrain from mentioning one more thing. I refer to the work which is being done from year to year by our grand old man, "The Deacon;" if you please, our worthy secretary. He has always the interest of this Association at heart and can make more bother in the shortest time, for the fellow who deserves it, than anyone I have ever seen. His work for many years has been highly effect-

ive for the good of the Association and I know that it has been appreciated. Again, I thank you. (Applause.)

President.—I wish to announce that I will appoint our worthy member, Mr. B. F. Pickering, assistant secretary. We will now have a short intermission for the payment of dues, distributing badges, etc.

After a short intermission the meeting was again called to order by President Lichty.

President.—We will now have the annual reports of the secretary and treasurer, if they are ready.

Secretary Patterson thereupon read his annual report.

REPORT OF THE SECRETARY.

PITTSBURG, PA., October 17, 1905.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: Another year has passed and it again becomes my duty to make my annual report. First I will say that we all should be truly grateful that, so far as I know, death has not entered our ranks during the year, and we meet today under very favorable circumstances. The past year has been the banner year for the Association, having added 90 new names to our roll, making a total of 290 members. We desire to express our appreciation to our advertisers, who have again so generously taken space in our published proceedings, and I wish personally to express my thanks to the officers and members for their loyal support and sincerely wish for the further success of this Association.

FINANCIAL.

Cash on hand at the last report	$44.79
Cash received for dues and new members	896.00
Cash received for advertisements	1,106.75
Cash received, sale of books	55.75
Total receipts	$2,103.29

CR.

By cash paid out, covered by vouchers	$1,946.98
Balance on hand	$156.31

S. F. PATTERSON,
Secretary.

President.—Gentlemen, you will see from the report that "The Deacon" always comes out a little ahead, that is, with a credit balance.

Mr. Cummin.—I move that the report be referred to the Auditing Committee.

Mr. Montzheimer.—I second the motion.

President.—It has been moved and seconded that this report be referred to the Auditing Committee. All in favor of this action signify it by saying "Aye." Those to the contrary, "Nay." The motion is carried.

Secretary Patterson then read the annual report of the treasurer.

TREASURER'S REPORT.

LAWRENCE, MASS., October 7, 1905.

To the President and Members of the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: Your treasurer submits the following report for the year ending October 17, 1905:

Cash on hand, last report	$637.95
May 19, 1905. Interest on deposit	23.10
September 22, 1905. Received from secretary	100.00
Cash in bank	$761.05
Cash in hands of treasurer	.13
Total	$761.18

C. P. AUSTIN,
Treasurer.

Mr. Cummin.—I move that it take the same course.

Voice.—I second the motion.

President.—If there are no objections this report will take the same course as that of the secretary.

Assistant Secretary Pickering read a letter from the treasurer, regretting his inability to be present at the Convention.

A vote of sympathy for Mr. Austin was then unanimously carried with regard to the illness of Mrs. Austin.

President.—The secretary has received letters from quite a number of members who are unable to be with us, and I

would like to have the assistant secretary give the names, so we will know who they are. Some of them are old members and we will be glad to hear from them.

The assistant secretary thereupon gave the names of the members whose letters he held, expressing regret, as follows: W. G. Berg, Moses Burpee, D. A. Shope, J. M. Wilkinson, E. Fisher, William Carmichael, S. D. Bailey, J. D. Lacy, F. Ingalls, W. E. Alexander, W. R. McKeel, W. B. Yereance, M. Riney, R. J. Bruce, J. P. Snow, W. A. Rogers, J. D. Gilbert, B. T. McIvers, James Stannard, D. C. Zook, G. Larson, R. C. Sattley, J. T. McIlwain, W. H. Finley and G. J. Bishop.

President.—I think the report is now ready on applications for membership, and we will hear it, if the assistant secretary will please read it.

Mr. Pickering then read the report of the Committee on Applications.

REPORT OF COMMITTEE ON APPLICATIONS.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

On the strength of members of this Association recommending applicants, the following applicants are recommended for membership in the Association:

BROWN, J. B., Kansas City, Clinton & Springfield Ry., Clinton, Mo.
CARMAN, FRANK V., Southern Pacific Co., West Oakland, Cal.
HORN, U. A., Missouri Pacific R. R., Osawatomie, Kas.
HUBBARD, ANDREW B., Boston & Maine R. R., Boston, Mass.
KRAUSCH, WALTER T., C., B. & Q. R. R., Chicago, Ill.
MUSTAIN, BAILEY J., El Paso & No. Eastern R. R., Alamogordo, N. M.
POTTS, J. O., Missouri Pacific R. R., St. Louis, Mo.
RAND, FRED C., Boston & Maine R. R., Boston, Mass.
REAGAN, J. W., Arizona & Colorado R. R., Farmington, N. M.
WACKERLE, L. J., Missouri Pacific R. R., St. Louis, Mo.
TALBOT, JOHN L., A., T. & S. F. Ry., Pueblo, Col.
HAUSGEN, F. W., Missouri Pacific R. R., Pacific, Mo.
McKIBBEN, ROBERT, P. R. R., Dravosburg, Pa.
CARSON, D. J., B. R. & P. R. R., Du Bois, Pa.
JUTTON, LEE, C. & N. W. R. R., Chicago, Ill.

Musser, G. D., P. R. R., Wellsville, O.
Scheetz, F. B., Missouri Pacific R. R., St. Louis, Mo.
Fullem, T. J., I. C. R. R., Chicago, Ill.
Bender, H., Wisconson Central Ry., Fond du Lac, Wis.
Curtin, William, C. & N. W. Ry., Boone, Ia.
Flynn, M. J., C. & N. W. Ry., Chicago, Ill.
Zinsmeister, E. C., B. & O. R. R., Zainesville, O.
McKeel, W. S., G. R. & I. Ry., Grand Rapids, Mich.

GROSVENOR ALDRICH,
W. O. EGGLESTON,
Committee on Applications.

President.—We will now listen to the report of the Executive Committee.

REPORT OF EXECUTIVE COMMITTEE.

Pittsburg, Pa., October 17, 1905.

To the Officers and Members of the Associaton of Railway Superintendents of Bridges and Buildings:

Gentlemen: The Executive Committee met in Chicago at the close of our last annual (fourteenth) Convention and the usual routine business was transacted. The appointment of the various committees was left to the president, who, later, sent a circular to the members, announcing the appointments. Mr. J. H. Cummin was appointed a committee to procure badges for our fifteenth Convention. The secretary was authorized to pay bills the same as heretofore.

By call of the president, the Executive Committee met in Chicago March 22, 1905, a quorum being present. The local committee made a report in regard to accommodations for our fifteenth Convention, which was accepted, with the privilege of further perfecting the same.

Committee called to order at 12 o'clock noon, Tuesday, October 17, 1905, at Hotel Monongahela, Pittsburg, Pa.

Members present: B. F. Pickering, J. H. Cummin, H. Rettinghouse, W. O. Eggleston, A. E. Killam, C. A. Lichty, S. F. Patterson and J. S. Lemond.

On regular motion, it was decided to take up, with the Pullman Company, the subject of return passes, and Mr. C. A. Lichty was appointed a committee on one to call on the general superintendent at Chicago to endeavor to make some arrangement satisfactory to all concerned in lieu of the arrangement which has heretofore been in vogue, and which the Pullman Company decided to discontinue after this year.

Mr. Cummin was appointed a committee of one to arrange with the local representative of the Pullman Company at Pittsburg for return sleeping car accommodations.

Secretary Patterson read the annual report of the Executive Committee, showing the Association to be in a splendid condition.

The report was accepted and on motion the above minutes were approved as read. On regular motion, in absence of any other business of importance to come before the committee, the meeting was adjourned.

S. F. PATTERSON,
Secretary.

Mr. Pickering.—Two years ago at Quebec, we took in some new members almost at the very last minute of the Convention—some very fine members—and I think it would be well to hold the list open until the close of this Convention.

Mr. Cummin.—I think as to the order of business, as to applications for membership, that it is like sickness and distress, it is never closed. I move that the assistant secretary cast one ballot for the names that have been read.

Mr. Killam.—I second that motion.

President.—It has been regularly moved and seconded that the assistant secretary cast one ballot for the names that have been proposed for membership in this Association. All those who favor this mode of procedure will please say "Aye." Motion carried.

Mr. Pickering.—I cast this list as read, as a ballot for these names for membership in this Association.

President —I declare these applicants duly elected members as recommended by the Committee on Applications.

President.—Next follows the appointment of the necessary committees, and I will now announce the following:

AUDITING COMMITTEE.

A. Montzheimer, H. D. Cleaveland, G. H. Soles, A. B. Hubbard.

COMMITTEE ON SELECTION OF SUBJECTS.

B. F. Pickering, J. H. Cummin, H. Rettinghouse, W. O. Eggleston, J. N. Penwell, C. W. Richey, R. L. Heflin.

COMMITTEE ON NOMINATIONS.

J. H. Cummin, B. F. Pickering, A. Montzheimer, W. O. Eggleston.

COMMITTEE ON RESOLUTIONS.

W. F. Steffens, J. P. Canty, R. H. Reid, B. M. Hudson.

Assistant Secretary.—I would like to hold a meeting of the Committee for the Selection of Subjects at the close of the session this afternoon, in one corner of this Convention hall. Also, would like to announce that I wish to see all the New England members and the members from the Eastern Provinces of Canada at my room, No. 155, at an early hour this evening.

President.—If there is no objection we will now stand adjourned until 2 o'clock this afternoon.

AFTERNOON SESSION, TUESDAY, OCTOBER 17, 1905.

The meeting was called to order by the president.

President.—Committee reports are in order.

The first is report on subject number one, "Construction and Maintenance of Docks and Wharves," Mr. H. Rettinghouse, chairman.

Report of the committee on subject number one, "Construction and Maintenance of Docks and Wharves," was thereupon read by the chairman of the committee, Mr. H. Rettinghouse, Division Engineer of the Wisconsin Central Railway. (See report on subject number one.)

Mr. Rettinghouse.—There is accompanying this report a letter from Mr. L. J. Anderson of the C. & N. W. Ry. and one from Mr. J. S. Browne of Providence, R. I., but it is not necessary to read them as they refer to one particular construction only. (See letters from Mr. Anderson and Mr. Browne.)

President.—I think it is customary to have all these reports taken up and have the discussions afterwards. That is right Mr. Cummin, is it not?

Mr. Cummin.—Yes, sir.

President.—The next will be report on subject number two, "Relative Value of Concrete and Timber Piles." I think there is no report on subject number two. (No report on subject number two.)

Mr. Schall.—Before passing the subject of concrete piles, I would like to ask whether permission will not be granted to have the subject discussed.

President.—We will have the discussion when the proper time comes; quite a few are interested in it and I think we will be able to have some discussion on it. We will bring it up later.

Mr. Pickering.—I would suggest, as chairman of the Committee on Subjects for next year, that as there has been no report made on this subject that it be carried over and continued as a subject for next year. We have done that in the past very frequently to good advantage.

President.—As Mr. Pickering is the chairman of the Committee on Subjects, I hope he will bear that in mind in making up the new list for the coming year.

President.—Report number three next, "Concrete Building Construction, Including Platforms," Mr. C. W. Richey, chairman.

Report of committee was thereupon read by the chairman, Mr. C. W. Richey, Master Carpenter of the Pennsylvania Lines, Pittsburg, Pa. (See report on subject number three.)

Mr. Richey.—That concludes the report of the committee on the subject of platforms. I will now read that part of the report relative to concrete buildings. Mr. Cunningham is the only member of the committee whom I have seen; the report is not yet signed by him, but he is perfectly satisfied with it and will sign it later. I have photographs of the concrete building at McKee's Rocks, erected by Mr. Cummings, whose office is just across the street. We will visit that building at McKee's Rocks Thursday. It is in the vicinity of the shops and something not very often seen—concrete roof trusses of segmental design, spaced 20 feet centers, etc.

President.—While on this subject, I will say that I have a letter here from a member in New Zealand. It might properly come up under the head of discussion, but I think

we will make it a supplement to the report, and as it is very short I will read it. (Letter referred to thereupon read by president, Mr. Lichty.) (See letter.)

President.—I am informed that the Auditing Committee is ready to report. As the chairman expects to be away part of the time later on, perhaps it would be well to have that now. If there is no objection we will hear the report, Mr. Montzheimer, chairman.

The report of the Auditing Committee was thereupon read by Mr. Montzheimer:

REPORT OF AUDITING COMMITTEE.

MONONGAHELA HOUSE, PITTSBURG, PA., October 17, 1905.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

The undersigned Auditing Committee beg to state that we have examined the accounts of our secretary, Mr. S. F. Patterson, and of our treasurer, Mr. C. P. Austin, and have the following report to make:

Secretary's report:	
Cash on hand last report	$44.79
Received during the year for dues and membership fees	896.00
Received for sale of books and tables	55.75
Received for advertising	1,106.75
Total	$2,103.29
Disbursements:	
Expenses, as per vouchers	1,946.98
Balance in secretary's hands, October 17, 1905	156.31
Balance in hands of treasurer, same date	761.18
Cash balance on hand	$917.49

ARTHUR MONTZHEIMER,
H. D. CLEAVELAND,
G. H. SOLES,
A. B. HUBBARD,
Auditing Committee.

President.—What shall we do with this report? It has been moved that this report of the Auditing Committee be adopted. All those in favor of this please signify it by the usual sign. The motion is carried.

President.—The next is the report on subject number four. I think this report has been printed and distributed and it is not necessary to read it unless some of the members wish it read.

Mr. Steffens.—If it is in order, I should like to say that the continuity of any report is going to be lost entirely if we go through the printed reports and discuss them afterwards. Mr. Richey just read a long paper, of which the members undoubtedly made mental notes that will be entirely obliterated and it would seem that the discussion would be in order after the report, in each case.

President.—It seems that might be the case where a report is read which has not come to us in printed form, and I should like to hear from some of the members on this point.

Mr. Montzheimer.—It has always seemed that the discussion should came after the reading of a report, because there will probably be several members here tomorrow who would take part in the discussion of some report that might be read today, and if the discussion comes after the members hear it read, those who come in tomorrow would be more apt to hear the report read and take part in the discussion.

Mr. Cummin.—Mr. President, under the circumstances I have been a little disappointed today, because it has always been understood in this Association that when a committee is appointed on a subject they should prepare their report and have it in the secretary's hands not later than the first day of September. The secretary has orders to print those reports in pamphlet form and send them out to all the members of this Association. That gives the members plenty of time to read over these reports in full and

to be ready to discuss them, but in this case the chairman of some of the committees have been unable to get their reports ready in time to be printed in the usual way. Those who have heard the reading of the reports can just as well discuss them tomorrow, as we can now, because the principal features will certainly be retained for 24 hours or less. I only regret that the report on the subject of concrete and also docks could not have been printed and placed in the hands of the members several weeks ago. In that connection I would like to say that it seems that there have been sent out large numbers of circulars to the members of this Association, but for your information would state that I never received one of those: if I had, I might have been able to give you some information regarding docks and wharves on the Atlantic coast.

President.—I would like to take a vote on this, as to how many prefer to discuss these reports as they come up and how many prefer to delay the discussion until we get through with the reports.

Upon taking a vote, it was decided to delay the discussion until the reports were all read.

President.—The report on subject number four, "Anchors for Plows and Derricks," Mr. R. J. Arey, chairman. I do not think it necessary to have it read, as all members have received a copy of the report. (See report.)

President.—Subject number five, "Methods of Repairing Roofs of Various Kinds," Mr. J. N. Penwell, chairman.

President.—Mr. Penwell, have you anything further to add to the report?

Mr. Penwell.—I have two or three letters to read, when the discussion comes up, that have been lately received.

President.—Report on subject number six, "Methods of Watering Stock in Transit," Mr. J. O. Thorne, chairman. (No report.)

President.—Report on subject number seven next, "Protection of Water Tanks and Water Pipes from Action of

Frost," Mr. J. P. Canty, chairman. I do not think it necessary to take it up at this time and it will be treated the same as the others. (See report.)

President.—Next is the report on subject number eight, "Recent Practice in Coffer Dam Work," Mr. W. F. Steffens, chairman.

Mr. Steffens.—Mr. President, I believe you had, in the spring, my request to be relieved of the chairmanship of that committee.

President.—This is a good subject and I think it would be wise if the committee would carry it over for next year.

President.—We now come to the reports of standing committees. Shall we take up these reports before the discussion of the regular subjects?

Mr. Cummin.—That brings up the same question that was raised a short time ago by a few of the members. The standing committees have not done very much, but if you have any reports, I would suggest that we hear them, and if not, we will get a chance to discuss some of the committee reports this afternoon.

President.—We have some reports to offer and will have them now. The first of the subjects of the standing committees is, "Pile and Frame Trestle Bridges," Mr. F. S. Edinger, chairman. (No report.)

Subject number two, "Steel Bridges," Mr. H. H. Eggleston, chairman. A very good report on that has been printed. Also, a supplementary report by Mr. Snow, one of the members from the Boston & Maine R. R. (See report.)

Subject number three, "Buildings." (No report.)

Subject number four, "Docks and Wharves," Mr. R. Angst, chairman. (No report.)

Subject number five, "Water Supply," Mr. B. M. Hudson, chairman. Mr. Hudson, have you any report?

Mr. Hudson.—We have no report to offer on this subject. (No report.)

President.—Next is subject number six, "Fire Protection," Mr. George W. Andrews, chairman. I would say that I received a letter from Mr. Andrews, saying that he was unable to do anything with the report and asked for further time.

President.—Subject number seven, "Fences, Crossings and Cattle-Guards," C. S. Corrigan, chairman. I do not remember seeing any report on this subject. (No report.)

President.—Subject number eight next, "Preservatives for Wood and Metals," Mr. F. D. Beal, chairman. We have something on this, which will come up for discussion. (See report.)

President.—Subject number nine, "Coaling Stations and Cinder Pits," Mr. W. B. Causey, chairman. (No report.)

President.—Subject number ten, which is the last, "Records and Accounts," Mr. H. M. Henson, chairman. Assistant Secretary, will you please read the report from Mr. Henson?

Report on subject number ten was thereupon read by Mr. B. F. Pickering, the assistant secretary. (See report.)

President.—This concludes the reports of committees. We will now take up the discussion of reports, gentlemen, if you are ready.

President.—Subject number one, "Construction and Maintenance of Docks and Wharves," is now open for discussion. We should like to hear from the new members and others who can offer anything on this subject in the interest of the Association.

Mr. Cummin.—Mr. President, I think it is customary for the chairman to start the discussion. (See discussion on subject number one.)

President.—We will now take up for discussion subject number two, "Relative Value of Concrete and Timber Piles."

No paper being presented, I believe it has been decided to continue this subject until next year, in which case we had better not have any discussion on it at this time, but

wait until it comes up in the proper shape. If there is no objection, we will pass to the next subject, number three.

(No discussion on subject number two.)

President.—We are now ready for discussion on subject number three, "Concrete Building Construction, Including Platforms." I believe, according to Mr. Cummin's views, that it is usually customary to hear from the chairman first. Mr. Richey, we would like to hear from you. (See discussion on subject number three.)

Mr. Steffens.—I move that we adjourn until tomorrow morning at nine o'clock.

Motion prevailed.

MORNING SESSION, WEDNESDAY, OCTOBER 18, 1905.

Meeting called to order by the president at 9.25 a. m.

President.—The Committee on Nominations will please make their report.

The report of the Committee on Nominations was read by Assistant Secretary Pickering.

REPORT OF COMMITTEE ON NOMINATIONS.

PITTSBURG, PA., October 18, 1905.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

Your Committee on Nominations submits the following report:

For President—J. B. Sheldon.
First Vice-President—J. H. Markley.
Second Vice-President—R. H. Reid.
Third Vice-President—R. C. Sattley.
Fourth Vice-President—J. P. Canty.
Secretary—S. F. Patterson.
Treasurer—C. P. Austin.
Executive Members—H. Rettinghouse, A. E. Killam, J. S. Lemond, H. H. Eggleston, C. W. Richey, F. E. Schall.

J. H. CUMMIN,
B. F. PICKERING,
ARTHUR MONTZHEIMER,
W. O. EGGLESTON,
Committee.

President.—This report will be held for whatever action the Association sees fit to take when it comes up tomorrow in the regular order of business.

Mr. Cummin.—It might be well to inform the new members of the Association that this report is not final. When the time for election of officers comes it does not prevent other nominations for any office. It is simply a matter of form, in order to bring certain names definitely before the Association.

President.—We will resume work on subject number three, "Concrete," where we left off last night, and I trust that you will confine your remarks to the subject. (See further discussion.)

President.—Subject number four, "Anchors for Plows and Derricks."

It is gratifying to note how well the chairman of the committee, a new member from the Santa Fé, has handled this apparently barren subject. The paper is now open to discussion. (See discussion.)

President.—Subject number five, "Methods of Repairing Roofs of Various Kinds." Mr. J. N. Penwell of the Lake Erie & Western is chairman and we shall be glad to hear from him first. (See discussion on subject number five.)

President.—I should like to read the report of the Committee on Relief at this time.

Report thereupon read by the president.

REPORT OF COMMITTEE ON RELIEF.

MONONGAHELA HOUSE, PITTSBURG, PA., October 17, 1905.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

Your Committee on Relief are glad to state that during the past year we have had but one application for relief.

About half a dozen letters were sent out to various members of the Association, stating the applicant's age, experience, etc. The responses were prompt and a very satisfactory position was offered the applicant, which he accepted.

ARTHUR MONTZHEIMER,
JOHN B. SHELDON,
JAMES STANNARD,
M. RINEY,
Committee.

President.—Subject number six, "Methods of Watering Stock in Transit." Mr. J. O. Thorn of the Chicago, Burlington & Quincy is the chairman. He is not present. There is no report on that subject and this is one of the subjects that it has been decided to continue; we will, therefore, pass to subject number seven. (See paper by E. S. Hume of Western Australia Government Railways.)

President.—Subject number seven, "Protection of Water Tanks and Water Pipes from the Action of Frost," Mr. J. P. Canty, chairman. Have you anything further to offer, to start the discussion, Mr. Canty? (See discussion.)

President.—Subject number eight, "Recent Practice in Coffer Dam Work." There is no report on this subject. This is one of the subjects that is to be continued and carried over till next year. If there is no objection, we will now take up standing committee reports.

(No discussion on subject number eight.)

Mr. Pickering.—We have a telegram from one of our old members, whom we have missed and whose pleasant face we all would so much like to see, and I am sure everyone has felt a personal loss because he has not been here at this time.

TERRE HAUTE, IND., October 17, 1905.

S. F. PATTERSON,
Care Monongahela Hotel, Pittsburg, Pa.

Very sorry we cannot attend Convention; too much prosperity. Hope for an interesting and profitable time, as usual.

A. S. MARKLEY.

I think this is a fine message from our brother. You all, or most of you, know Brother Markley's disposition, and you know that if he was with us he would be an earnest worker.

President.—We are now ready to take up the standing committees. The first is "Pile and Frame Trestle Bridges," Mr. F. S. Eddington of the Southern Pacific, chairman.

There is no report on this subject. Has any member anything to offer on this? (See discussion on number one.)

President.—Gentlemen, if you will pardon me at this

time, we will see if the committee has made any progress in regard to reporting on the Pullman transportation.

Mr. Cummin.—Mr. President, a representative of the local Pullman office will be present at 9.30 o'clock tomorrow morning, at which time return trip can be arranged for, over a different route, if desired, than originally selected.

Mr. Killam.—I move that we now adjourn.

President.—If there is no objection we will stand adjourned until two o'clock this afternoon.

AFTERNOON SESSION, OCTOBER 18, 1905.

Meeting called to order by the president.

President.—Gentlemen, if you will now please come to order we will take up the next subject of the standing committees, which is subject number two, "Steel Bridges." Mr. H. H. Eggleston is the chairman. (See discussion on subject number two.)

President.—Subject number three, "Buildings." There is no report on this subject. Has anyone anything to offer? If not we will pass to the next subject. (No discussion on subject number three.)

President.—Subject number four next, "Docks and Wharves." That was pretty well covered in the report on subject number one of the regular committee reports, and probably there is nothing else to be offered on that here; if not, we will pass to the next subject. (No discussion on subject number four.)

President.—Subject number five, "Water Supply." On this subject there has been no report made. Has anyone anything to offer on this line? (No discussion on subject number five.)

President.—Number six next, "Fire Protection." No report on this subject. Has anyone any suggestions in connection with our work on this subject of fire protection?

Mr. Reid.—Fire protection for buildings or bridges?

President.—I think it is general. Anything of general interest that might come up under this head. While there

is no report on this, I know that some of the standing committees were very nearly ready to report this year. This part of the work is a new feature, however, but we will have some reports further along. (See discussion on subject number six.)

During the discussion on fire protection, Mr. John Foreman of the Philadelphia & Reading R. R., at Pottstown, Pa., and one of the life members of the Association, arrived at the Convention and was given a hearty welcome.

Mr. Pickering.—Mr. President and gentlemen, I want to introduce Mr. John Foreman, the oldest bridge man in America.

Mr. Cummin.—For the information of some of the new members I will state that this gentleman worked for one railroad for 58 years before he retired. I do not think his record will be equalled by any man in this country.

President.—Some of these subjects, under the head of standing committees, if not all of them, have been an experiment. This is the first time they have been before the Convention, and while we did not have the best of reports at this meeting and no reports at all on some of the subjects, it is being shown that there is plenty of good material to work on. These will be continued and I hope my successor will be successful in appointing committees.

Mr. Pickering.—I would ask for permission to withdraw to Room 155 for consideration of the question of the selection of subjects, for myself, J. H. Cummin, Mr. Rettinghouse, W. O. Eggleston, Mr. Penwell, C. W. Richey and Mr. Heflin.

President.—If there is no objection, we will allow these members to withdraw from the meeting at this time.

President.—Subject number seven, "Fences, Crossings and Cattle Guards." Please make your remarks as brief as possible. There has been no printed report made on this subject. (No discussion on subject number seven.)

President.—Subject number eight. We have a paper on that and want to discuss it, but please make your remarks

very brief and to the point and keep within the limits of the subject. This subject is, "Preservatives for Wood and Metals." Has anyone anything to offer besides the report which is in? If not, we will pass it, as I think the Maintenance of Way Association are now discussing this subject. (No discussion on subject number eight.)

President.—Subject number nine, "Coaling Stations and Cinder Pits," on which there is no printed report.

Mr. H. H. Eggleston.—Mr. President, Mr. Causey, chairman of that committee, has been so busy that he could not get his report out, but I think I will get something here from him tomorrow.

President.—All right, if we hear from him we will bring this matter up again tomorrow. We will now pass to the next subject. (No discussion on subject number nine.)

President.—Subject number ten, "Records and Accounts." (See discussion on subject number ten.)

THURSDAY MORNING, OCTOBER 19, 1905.

Meeting called to order by the president at 9.40 a. m.

President.—Gentlemen, we have a report of one more committee that was to be handed in this morning. Is Mr. H. H. Eggleston present?

Mr. H. H. Eggleston.—Here is the report, which I have just received from Mr. Causey.

President.—Will the assistant secretary please read the report which comes in at this time from Mr. Causey?

Report on "Coaling Stations and Cinder Pits," subject number nine, was thereupon read by Mr. Pickering, the assistant secretary. (See report.)

The assistant secretary also read a letter from Mr. W. D. Causey of the Chicago & Alton R. R. Co., stating that he had been unable to prepare a full report on account of the overwhelming amount of work in the maintenance department this year.

Mr. Pickering.—Mr. President, the Committee on the Selection of Subjects for next year concluded to continue

this subject and consequently I would suggest that this be laid on the table and referred to the committee to be appointed next year.

President.—What is your pleasure, gentlemen? Do you think it ought to go in this year's records, or be carried over until next year?

Mr. Large.—I think it had better be carried over till next year.

President.—Does anyone want to discuss this subject this morning?

Mr. H. H. Eggleston.—At the next Convention I shall, I think, be able to give the Convention considerable information on this subject, as we are changing our coaling apparatus entirely, over the entire system.

President.—I wish to state that Mr. Causey was one of the new members last year and is a very able man. I should like to see the same committee continued, as I know a good report will result. What is your pleasure, gentlemen? I should like to know whether you want to take this up and include it in this year's report. I think it would be much better to carry it over, if someone will make a motion to that effect.

Mr. Large.—I move that it be carried to next year's Convention. (The motion was carried.)

President.—I wish Mr. Eggleston would tell Mr. Causey that this subject is continued, request him to be chairman and take this report.

Report was thereupon turned over to Mr. Eggleston by the president. (No discussion on subject number ten.)

Mr. Pickering.—I rise to a point of privilege. I hold in my right hand a registration card of one of our members who has retired from railroad service. One of our old, faithful members, who has attended, I think, every Convention of this Association, at least all which I have attended myself, and taken a great interest. He has now retired from railroad service. He has visited the South for his health and has become so attached to that country that I

understand he intends making his permanent home at Miami, Fla. Mr. President, I move that Mr. James McIntyre be made a life member of this Association, with all privileges.

Mr. Cummin.—I second the motion.

Voices—Second the motion; second the motion.

President.—We have a good many seconds to this motion, which looks well and I am much pleased to put this question before the house for your consideration. It has been moved and seconded that Mr. James McIntyre, who has retired from active railroad service, be placed on the life membership of this Association. All those in favor of that motion please rise.

President.—The motion is carried unanimously, and I trust, Mr. McIntyre, that you will be a member for the next 40 years.

Mr. McIntyre.—Mr. President and gentlemen, I am not a speech-maker, but will make a few remarks on this line. I am not quite as ancient as my friend makes me out to be. I think it was in 1881 that I joined the Civil Engineers' Club of Cleveland, Ohio, and when I resigned they requested me to allow them to retain my name on their roll. The Masonic order in the Blue Lodge did the same thing. I thank you for your courteous action in this matter.

Mr. Cummin.—One thing about Mr. McIntyre's looks; if a few months' residence down there will change the looks of a man as it has him, I think some of the rest of us had better take a trip down there.

President.—The Committee on Resolutions is not quite ready to report. Has anyone anything to offer under the head of unfinished business?

Mr. Sheldon.—Mr. President and gentlemen, I rise to a matter of personal privilege. I move that Mr. Wise of the Illinois Central Railroad, a member who has been 26 years in active railroad service and now retired, who has always taken an active interest in the Association, be placed on the list of life members, with all privileges.

Mr. Pickering.—I second that motion.

President.—Gentlemen, I should like very much to see this honor conferred. All those in favor of that motion, that Mr. Wise be made a life member with all privileges, please acknowledge same by rising.

The motion is carried, and I declare Mr. E. F. Wise duly elected a life member of this Association.

Mr. Wise.—Mr. President and gentlemen, I am not a speech-maker, but I thank you for the honor conferred on me.

President.—I think the Committee on Subjects is now ready to make their report.

Report of the Committee on Subjects was thereupon read by the assistant secretary.

REPORT OF COMMITTEE ON SELECTION OF SUBJECTS.

PITTSBURG, PA., October 19, 1905.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

The Committee on Selection of Subjects submits the following subjects:

Number One. Concrete for bridges, arches and subways.
Number Two. Experience in use of concrete piles.
Number Three. Concrete building construction.
Number Four. Methods of watering stock in transit.
Number Five. Recent practice in coffer dam work.
Number Six. Modern coaling stations and cinder pits.
Number Seven. Most practical bumping block for passenger and freight use.

We recommend the standing subjects for committees be the same as last year.

B. F. PICKERING,
J. H. CUMMIN,
H. RETTINGHOUSE,
W. O. EGGLESTON,
J. N. PENWELL,
C. W. RICHEY,
R. L. HEFLIN,
Committee.

Mr. Pickering.—I will say in explanation of this report, Mr. President, that the committee thought some of the subjects had not been investigated as their importance called for and consequently thought it wise to continue them for further investigation and discussion.

Mr. Reid.—Would it not be well to add a standing committee on concrete to the standing committees?

President.—That would come under the head of buildings, of the standing committees.

Mr. Reid.—I would suggest that there be a standing subject for concrete. The subject is so broad that the appointment of a special committee seems warranted. The committee should not only include buildings, but arches, culverts, abutments and general work of all kinds.

President.—What is the pleasure of the Association? Do you want another standing subject with the title, "Concrete for Building and Structural Work?"

Mr. Pickering.—I would recommend adding a standing subject of "Concrete for Building and Bridge Construction."

Mr. Cummin.—I believe that for next year we should have a regular committee to report on the subject of "Concrete Bridges and Arches." We should not be as likely to get as good a report from a standing committee as from a regular annual committee.

Mr. Pickering.—Mr. President, it is my opinion that seven regular subjects are as many as we ought to have for special investigation each year. If we receive reports from four, which is about the average number usually received, it will take all the time available to properly discuss them. The subject, I realize as well as Mr. Cummin, is a very important one, but would it not be well to let this standing committee investigate the subject this year and if, by the following year, they do not present as full a report as we wish on the subject, make it a special subject for the next year.

Mr. Cummin.—That will carry it over for two years before we hear anything from it. A number of members are very much interested in concrete arches, bridges, etc., and as it is coming into more universal use constantly, this is a good subject to have before the Association. I move that this be selected as one of the regular subjects.

Mr. Large.—I second that motion. (Motion was carried.)

Mr. Penwell.—Since this subject has been added to the regular list, there are too many subjects for next year and I would move that we drop the subject, "The Construction and Maintenance of Docks and Wharfs," and substitute the subject that was just voted on instead.

Mr. Pickering.—Mr. President, I second that motion, in view of the fact that we had quite a full report and as I remember a very sharp discussion on this particular subject this year. (The motion was carried.)

President.—Nominations will now be in order for cities for holding the next Convention. We received the usual invitation from the bright spot, Milwaukee, as warm and hearty as ever, or even more so.

The following cities were regularly placed in nomination for the next meeting place: Cincinnati, New York City, Washington, Cleveland and Boston. Ballots were then canvassed, Messrs. Winter and Penwell, tellers.

President.—The result of the first ballot is as follows: Total number of votes cast, 49; Cincinnati had one; New York City, one; Washington, seven; Cleveland, nine; Boston, 31. I therefore declare Boston the place for holding our next annual Convention.

Mr. Cummin.—I move that the selection of Boston be made unanimous for the next meeting-place. (The motion was made unanimous.)

President.—Election of officers next, gentlemen. The nominations so far are as follows:

President, J. B. Sheldon; first vice-president, J. H. Markley; second vice-president, R. H. Reid; third vice-president, R. C. Sattley; fourth vice-president, J. P. Canty; secretary, S. F. Patterson; treasurer, C. P. Austin; executive committee, H. Rettinghouse, A. E. Killam, J. S. Lemond, C. W. Richey, H. H. Eggleston, F. E. Schall.

Mr. Montzheimer.—I move that the nominations be closed. (Motion was carried.)

Mr. Cummin.—I move that the assistant secretary cast the vote for the nominations made by the committee.

President.—It has been moved and seconded that the assistant secretary be instructed to cast one ballot for these names. If there is no objection, Mr. Pickering will cast one ballot for the election of these officers as recommended. But this must be unanimous if we do it in this way. All those favoring this motion signify it by saying aye; contrary, nay. The motion is carried and the assistant secretary will please cast the ballot.

Mr. Pickering.—Mr. President and members of this Association, it gives me great pleasure to cast this ballot for the names recommended by the committee for officers of this Association for the ensuing year.

The officers were then declared duly elected by the president and those present accepted the offices to which they were elected.

President.—Mr. Sheldon, will you please come forward? I now turn this gavel of authority over to you.

Mr. Sheldon.—Members of this Association, I appreciate in a measure the honor you have conferred on me by electing me president of this Association. I also appreciate somewhat the work that goes with the chairmanship of an association of this kind, as I have been reminded of it several times by our past presidents, but I will ask the members of this Association to help me do some of the work. There is work enough for us all and if the Association succeeds it must be done. You know my failing, and I shall feel free to call upon you to help me out.

At this point Mr. Steffens read the report of the Committee on Resolutions, which was accepted:

REPORT OF COMMITTEE ON RESOLUTIONS.

PITTSBURG, PA., October 20, 1905.

The Committee on Resolutions reports as follows:

Resolved, That the Association tenders its thanks to the railroads, the Pullman Company and other companies, individually and collectively, in appreciation of the courtesies so kindly

extended in connection with this, our fifteenth annual Convention.

To the local members who as a committee have been untiring in their efforts to make profitable and interesting the visit of the Association to the City of Pittsburg.

To the commercial houses that have been represented at this Convention and have aided materially the local committee in providing entertainment for the ladies and members present.

W. F. STEFFENS,
R. H. REID,
J. P. CANTY,
BEN. M. HUDSON,
Committee.

Adjourned.

S. F. PATTERSON,
Secretary.

W. C. KIKENDALL,
Official Stenographer.

COMMITTEE REPORTS

FOR 1905 AND 1906.

PRESENTED AT THE FIFTEENTH ANNUAL CONVENTION, PITTSBURG, PA., OCTOBER, 1905.

I.

CONSTRUCTION AND MAINTENANCE OF DOCKS AND WHARVES.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings.

When the announcement of membership of this committee was made by our president, assigning to me the chairmanship of same, I was not aware of the size of the job thrust upon me. To begin with, I have not had much assistance from the members of this committee, with the exception of the valuable suggestion and contributions from Mr. McGonagle. The others were simply ready to stand by me and that was all. The subject is one of very great importance and of great interest to many of our members and to many who are not members, but should be. It is difficult to explain, therefore, why I have received so few replies to circulars asking for that information so essential to a comprehensive report. After communicating with the members of the committee, it was decided to divide the investigation into two classes, viz.:

First: Ocean, or tide-water docks and wharves.

Second; Inland lake docks and wharves.

No replies at all have been received to circulars from our Atlantic and Pacific Ocean friends and as I happened to be an inland lake man and have no knowledge whatever of ocean docks, I must of necessity eliminate that part of the subject, leaving it as a separate subject to be reported upon in the future, and confine myself to inland lake docks. Specifically, the report is confined to merchandise docks and ore docks.

The harbors of the Great Lakes are lined with docks or wharves for shipping of all classes of merchandise and products, and the purpose of our investigation is directed towards wharf or dock fronts, disregarding the superstructures and machinery necessary for loading or unloading the respective kinds of freight.

Docks and wharf fronts, almost without exception, are of timber and pile construction. Standard plans of dock fronts have been received from several railroads. They are more or less all alike, consisting of a row of piling driven from three to five feet on centers, to a depth below dredging line along the front of dock. Usually two wales or fender streaks, sometimes only one, are placed horizontally on the outside of such front piling. These fender streaks have the double purpose of distributing the pressure from docking boats over front piling and holding such piling in position by means of anchor rods, which run back to a horizontal timber placed back of another row of piling, called anchor piling, which is driven parallel to and from 12 to 20 feet distance from dock front. In soft bottom, it is necessary to place still another parallel row of piling 12 to 20 feet farther

and connect with tie rods to second row. In rear of dock front, sheet piling, usually consisting of two thicknesses of plank, three to four inches thick each, is driven to a depth below dredging line, and in order to hold it in position, strips are placed horizontally between front and sheet piling. This sheet piling is for the purpose of making dock front tight and permitting filling to be made to a level with top of dock front. Dock fronts are usually capped longitudinally with one or two pieces of 12 x 12 inch timber. The fender or wales are, of course, subjected to the principal wear from docking boats and should be of hard wood. Opinions differ so radically as to minor details of construction, as, for instance, the relative value of this splice and that splice used in wales, caps, etc., that it is of little value to express any personal opinion in regard to same. All plans submitted and, consequently, the docks in use have that great fault, that the matter of later maintenance and reconstruction in the event of piling becoming decayed are not considered.

The lower wale or fender, as well as the anchor timbers (dead men), for anchor rods, should be placed so as to have the top of them about on the water level. This means, of course, additional expense in first construction, but it virtually perpetuates the life of the dock. Piling will decay in from six (6) to ten (10) years, according to its kind, above water line, and it is then only necessary to cut off piling and build up with timber. I have attached to this report typical plans illustrating these ideas.

The cost of such dock construction at the present time is about $18 to $20 per lineal foot, complete. The cost per 1,000 feet, board measure, of lumber in same is about $28. The cost per lineal foot of piles in place is from 18 to 25 cents, according to the kind of piles used, whether soft or oak.

For reasons already stated, reference to details of dock and wharf construction has been avoided; this applying equally well to corners, angles, etc., in dock front. They must be constructed to suit the occasion and no typical plan of any value can really be submitted. However, reference is had to the very excellent and valuable information contained in a report made by our member, Mr. J. P. Snow, to the second annual convention of the American Railway Engineering and Maintenance of Way Association. This report is accompanied by many illustrations and may serve as ready reference in regard to important, as well as minor, details of dock and wharf construction. Reference is also had to plan of Wilkesbarre Pier, submitted with full description by a member of this committee, Mr. J. S. Browne, of the New York, New Haven & Hartford Railway. Mr. Browne quotes interesting figures as to cost of construction and maintenance.

The ore docks of the Great Lakes are one type of dock which must take a prominent place and, having nothing in common with the foregoing dock and wharf fronts, are the only other division of the subject to be considered. Ore docks are nearly all alike as regards general construction, but this committee endeavored to get specific information from all railroads who owned ore docks as to the cost per lineal foot, cost per 1,000 feet, board measure, and cost per ton of storage capacity. It is to be regretted that replies were received from three out of eight inquiries only, and the largest and latest constructed docks are

Assn Ry Supts of Bridges & Buildings
Committee Report on Docks & Wharves
Typical Plan for Merchandise Docks

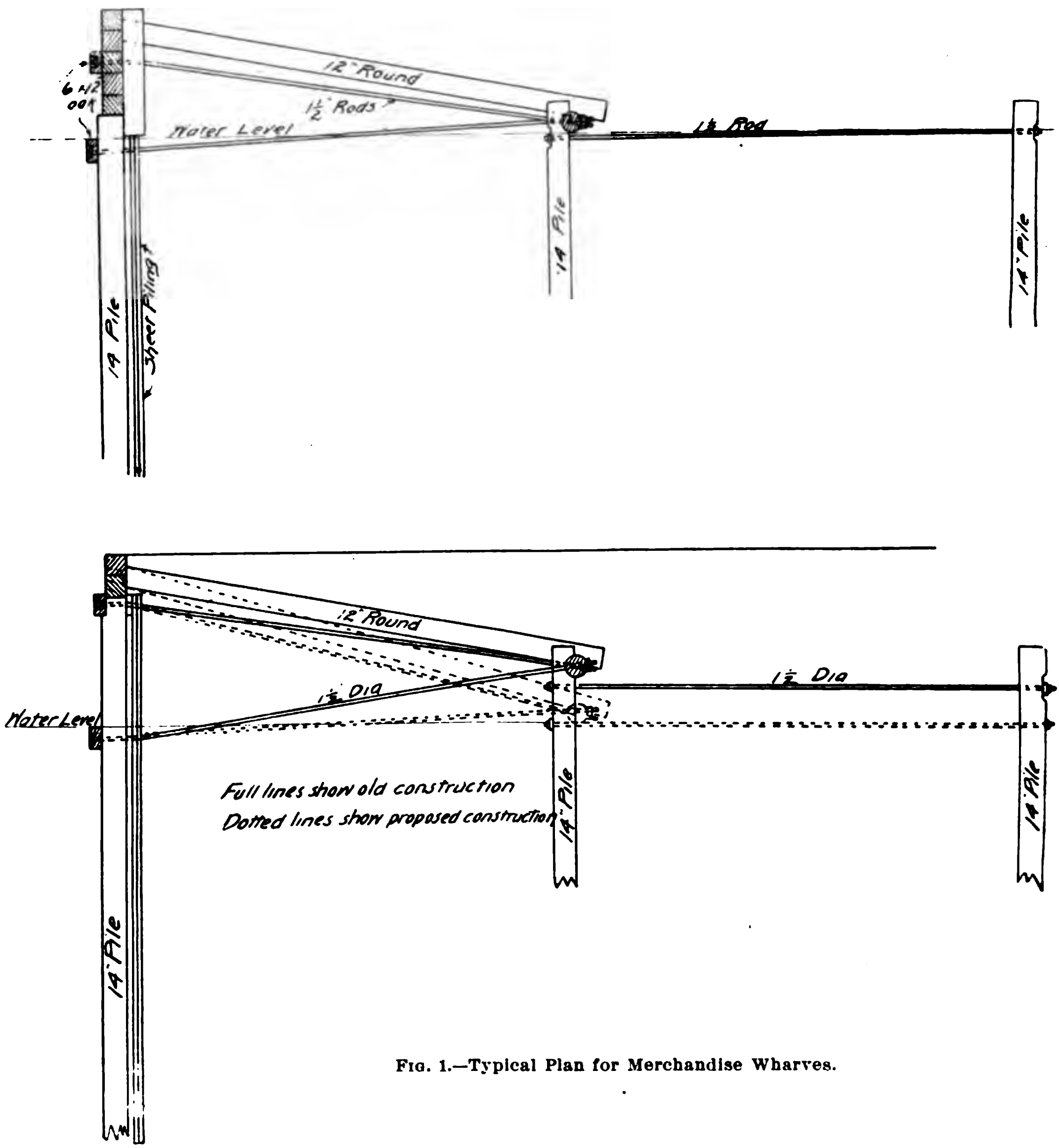


Fig. 1.—Typical Plan for Merchandise Wharves.

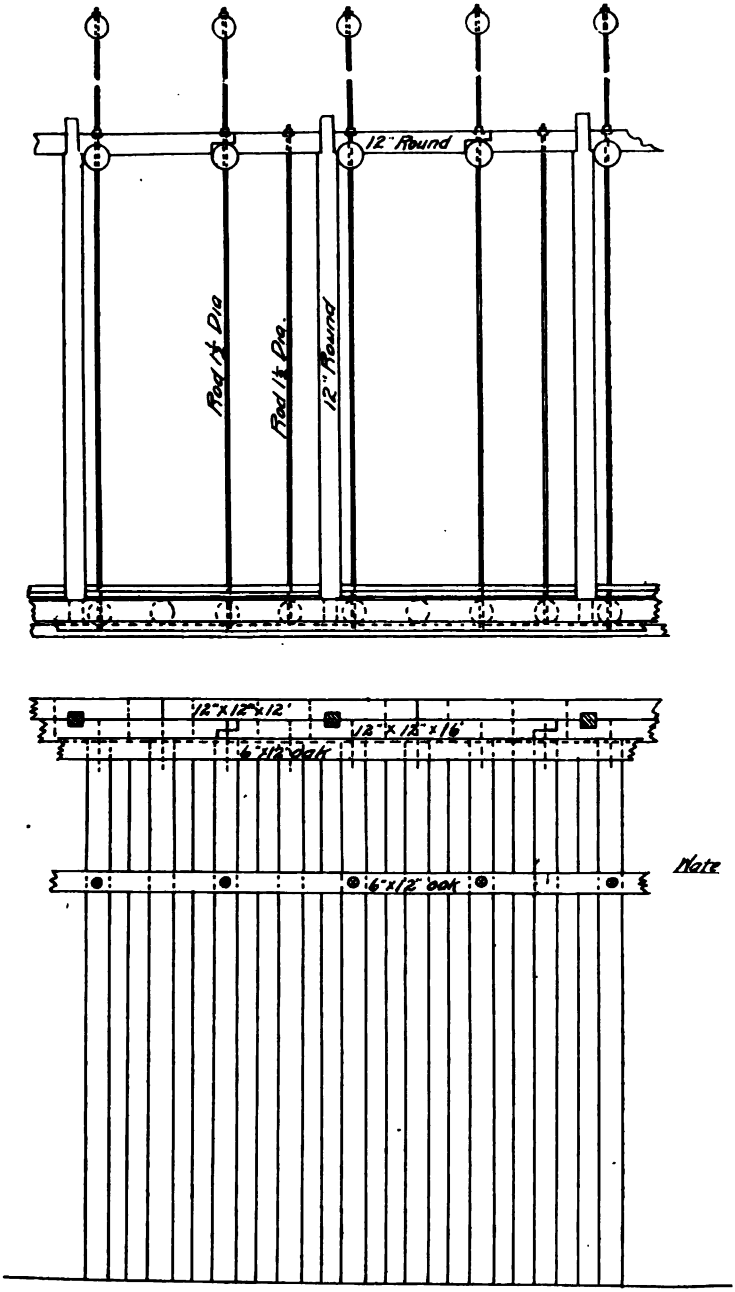


FIG. 2.—Typical Plan for Merchandise Pier.

not represented in the tabulation of cost. It has been the tendency of late, owing to the steadily rising price of timber, to reduce the amount of timber used in the construction of ore docks. In one instance, at least, this has proven rather disastrous and one of the latest docks constructed has begun to show decided signs of weakness. The following is a tabulation of cost of ore docks:

NAME OF ROAD.	Location.	Cost per Lin. Ft. of dock.	Cost per M. Ft. B.M.	Cost per ton Storage Capacity.
D. & I. R. Ry.....	Two Harbors, Minn.	$284.00	$29.00	$8.12
D. M. & N. Ry....	Duluth, Minn........	305.39	27.00	7.90
W. C. Ry.........	Ashland, Wis..	262.00	21.00	6.30

Attached to this report is also a table showing capacities and dimensions of all the ore docks of the Great Lakes. Referring to above table of the D. & I. R., D., M. & N. and W. C. Rys.: These docks are closely identical as to general construction and the low price of cost per lineal foot of W. C. Ry. dock as compared with those of the D. & I. R. and D., M. & N. is due to the extreme narrowness of the former and, in consequence, less amount of timber per lineal foot.

In regard to maintenance of ore docks, no figures are on hand. The lining of pockets consisting of maple lumber is about the first part of it to give out and needs renewal in about six years. Fenders and fender piles will last, on an average, 10 years, while the main body of dock has been known in some cases to last about 20 years, this referring to that part of dock being below pocket floors, as the same virtually roof the sub-structure and keep moisture from it. The super-structure above pocket floors is very much subjected to exposure and wear. Bottoms of end, partition and pocket posts decay very rapidly and demand close attention after from six to eight years. Attention is called to letter and accompanying plan from our member, and member of this committee, Mr. L. J. Anderson. The writer has always favored the plan advanced by Mr. Anderson as to ventilated construction of partition wall between pockets. However, the plan is not by any means original, as Mr. McGonagle has followed the same method at least at one of the D. & I. R. Ry. docks at Two Harbors and will certainly be in a position to explain the merits or demerits of the scheme. In two of the latest docks of the C. & N. W. Ry. at Ashland and Escanaba, another feature has been added, eliminating corners of pockets and providing for three outlet doors instead of one for each pocket. Spouts have been constructed to conform to this arrangement, and reports are to the effect that the method works to the greatest satisfaction. Reference is also had to plan submitted by Mr. Anderson and attached to this report, relative to a gate construction in lieu of three-pocket doors. It is an original invention of Mr. Anderson's and may have considerable merit, although the feasibility of it has thus far only been illustrated by a model.

RECORD OF ORE DOCKS ON THE GREAT LAKES.

RAILWAY.	Location.	Dock No.	No. pockets.	Stur. cap,—tons.	Height of water to center hinge in feet and inches.	Height of water to deck of dock, in feet and inches.	Width outside to outside partition posts, in feet and inches.	Length of spouts, in feet and inches.	Length of dock, in feet and inches.	Angle of pockets.
C. & N. W. Ry	Escanaba	1	184	24,104	28.10	45.6	37	21	1,104	39° 30′
C. & N. W. Ry	Escanaba	3	226	30,284	31.2	52.8	37	27	1,356	45°
C. & N. W. Ry	Escanaba	4	250	32,750	36.6	59.2	37	30	1,500	45°
C. & N. W. Ry	Escanaba	5	232	43,152	28.6	53.3	37	21.8	1,392	40°
C. & N. W. Ry	Escanaba	6	320	78,000	40	70	50.2	30	1,920	45°
C. & N. W. Ry	Ashland	1	234	58,000	40	70	50.2	30	1,404	45°
C. & N. W. Ry	Ashland	2	234	25,000	36.6	57.8	46.8	27	1,404	42°
D. & I. R. R. R.	Two Harbors	1	202	40,400	35.5	59.6	49	27	1,388	38° 42′
D. & I. R. R. R.	Two Harbors	2	208	41,600	38.5	57.6	49	27	1,280	38° 42′
D. & I. R. R. R.	Two Harbors	3	170	34,000	40	66	49	27	1,054	43° 32′
D. & I. R. R. R.	Two Harbors	4	168	36,960	37	62	49	29	1,042	38° 42′
D. & I. R. R. R.	Two Harbors	5	168	33,600	30	54.6	49	25	1,042	38° 42′
D., M. & N. Ry	Duluth	1	384	57,600	30	53	49	27.9	2,336	45°
D., M. & N. Ry	Duluth	2	384	69,120	32	57.6	49	27.9	2,336	45°
D., M. & N. Ry	Duluth	3	384	80,640	40.7	67.¼	59	27.9	2,304	45°
G. N. Ry	Superior	1	250	40,500	32.9	57	49	27.3	1,525	45°
G. N. Ry	Superior	2	350	87,500	40	72.8	62.8	32.4	2,100	45°
G. N. Ry	Superior	3	160	40,000	40	72.8	62.8	32.4	960	45°
D., N. & A. Ry	Marquette	1	270	27,000	25	45	40	20.4	1,700	39°
D., N. & A. Ry	Marquette	4	200	28,000	27.9	47.3	36.8	21.1	1,200	39° 45′
L. S. & J. Ry	Marquette	1	200	36,000	30.9	54	50	24.7	1,232	38° 40′
Wisconsin Central	Ashland	1	314	48,356	40	66.2	36.1	27	1,908	50° 45′
C., M. & St. P.	Escanaba	1	240	50,400	40.2¼	66.6	52	120.27 120.29	1,500	45°
A. C. & H. B. Ry	Michipicoten, Ont.	1	12	....	34	43.4	25	22.6	311.9	44°

It is thought that the foregoing report is not complete, especially as regards ore docks, and should be considered as a progress report only and it is earnestly requested that the investigation be continued with a view of making a full report on the cost of all ore docks now located on the Great Lakes.

Yours truly,

W. A. McGonagle,
A. A. Page,
J. S. Browne,
W. M. Moon,
L. J. Anderson,
L. D. Smith,
Committee.

H. Rettinghouse,
Chairman.

Providence, R. I., September 25, 1905.

Possibly some members of the Association may be interested in the brief description of a pier on the Providence River, which is used exclusively for the transferring of coal from vessels to cars.

This structure is known as the "Wilkesbarre Pier," from the fact that it was constructed about 1874 by the Wilkesbarre Coal & Iron Company of Pennsylvania and immediately sold to the railroad company. If it had been properly built, the main body would have been practically indestructible, because the marine animals were driven away a number of years ago by sewage from the City of Providence before they had done much damage, and there was very little decay in the timber, owing to its being always wet. The accompanying drawing shows the general plan and some details which will give an idea of the style of construction.

The piles used were spruce and they were too small and too short for the load to be carried, and no batter piles were used. The caps used were 10 by 10 spruce, with two short splices on each row of piles and fastened to the piles with drift bolts, and the floor was 3-inch spruce, rather indifferently spiked to the caps. The retaining walls were of stone, laid dry, and the space between was filled with gravel up to top of walls, which were about seven feet in height, and tracks were laid on the filling.

A large section of the outer end of this pier was wrecked about three years after it was built, by a drifting vessel in a storm, and when this portion was rebuilt the floor was placed at about high-water level. This was evidently a mistake, because the heads of piles and floor timbers are now so badly decayed that it will have to be rebuilt soon.

Owing to the poor construction, the remainder of the pier began to show signs of weakness about 10 years ago, due to settlement of the piles and separating of the splices on caps, caused by the wedging effect of the filling and, in 1896, these movements had progressed so far that a section about 200 by 35 feet on the southerly side collapsed and fell into the water.

This was dredged out and rebuilt, with the new floor about

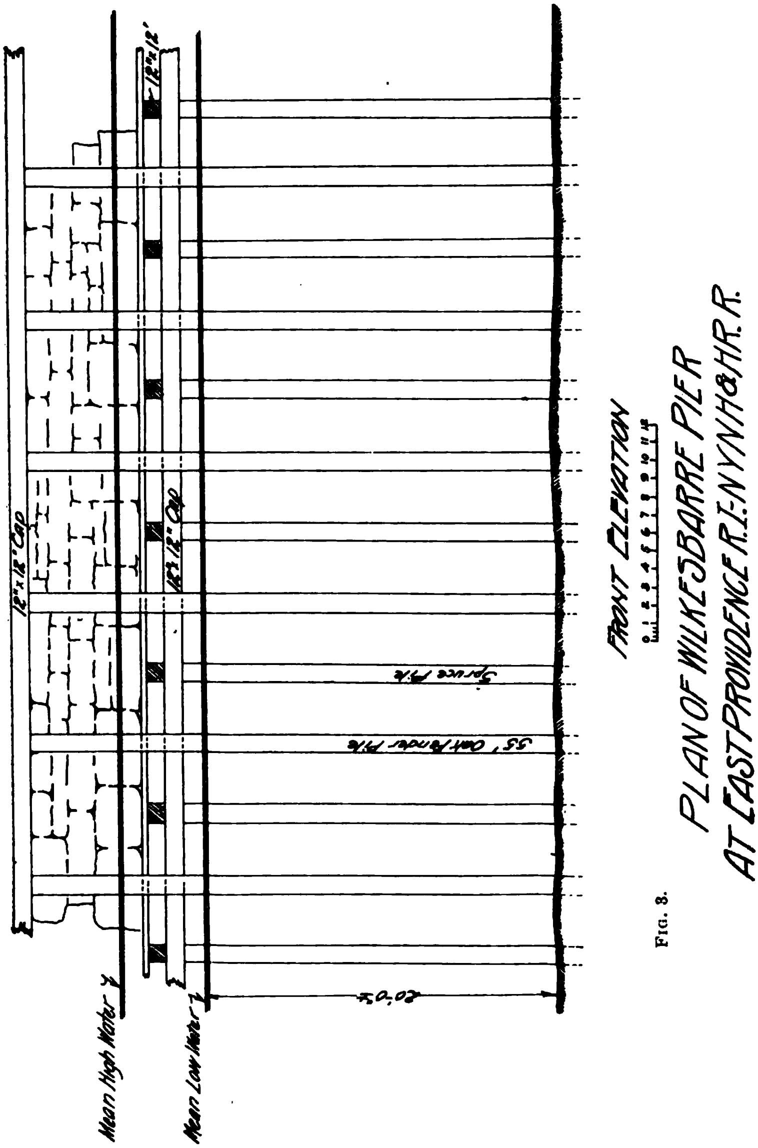

12"x12" Cap
12"x12"
12"x12" Cap
Spruce Pile
55' Oak Fender Pile
20'-0"
Mean High Water
Mean Low Water
FRONT ELEVATION
0 1 2 3 4 5 6 7 8 9 10 11 12
PLAN OF WILKESBARRE PIER
AT EAST PROVIDENCE R.I.: N.Y.N.H.&H.R.R.

FIG. 3.

two feet higher than the old, and no further trouble was experienced till about a year ago, when another section 300 by 45 feet threatened to collapse. This, however, was not allowed to fall, but was taken down and rebuilt, with new floor about 18 inches higher than the old, as we believe that there is no danger of decay in the timber if it is kept below about half tide.

In the new work, in addition to the plumb piles, a row of heavy batter piles were driven near the face and a 12 by 16 inches cap used in connection with them, while 12 by 12 inches caps were used at all other points and 4-inch hard pine floor.

The new floor was connected with the old by 12 by 12 inches timbers, spliced together strongly, and spiked fast to both. These ties were placed about 30 feet apart. The projecting ends of new caps were also spiked to the old floor. Of this area, 300 by 45 feet, or 13,500 square feet, were rebuilt during the past year, the total cost, exclusive of tracks, being about $18,500, or $1.37 per square foot, and the prices of the various items were as follows:

Excavation, including back fill, 55 cents per cubic yard.
Spruce bearing piles (45 feet long), $7 each, in place.
Chestnut batter piles (55 feet long), $12 each, in place.
Oak fender piles (55 feet long), $30 each, in place.
Hard pine timber, $50 per 1,000 feet, board measure, in place.
Removing old wall, $1.50 per lineal foot.
Building new wall (using old stone), $3.50 per lineal foot.
Pulling old piles, $4 each.

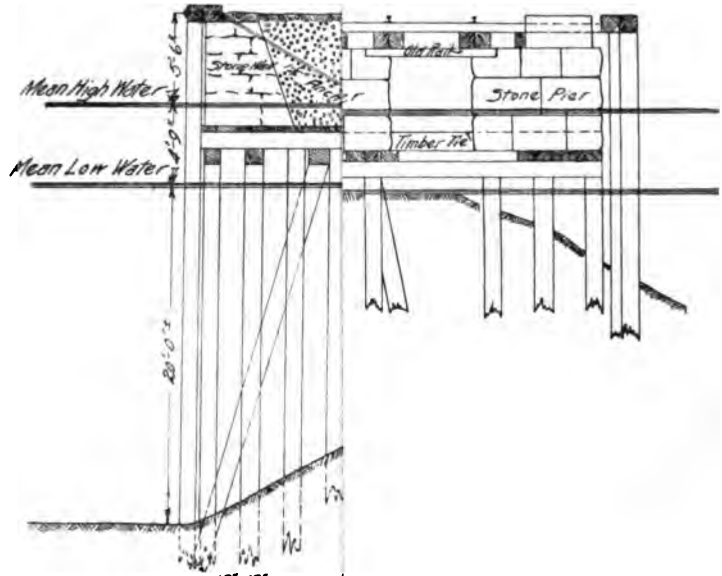
It would evidently have been better in the old work to have mortised the piles into caps, instead of drift-bolting them, especially on the two outer rows, as many of the bolts were rusted off between the pile head and cap, and the pile had escaped from its bearing.

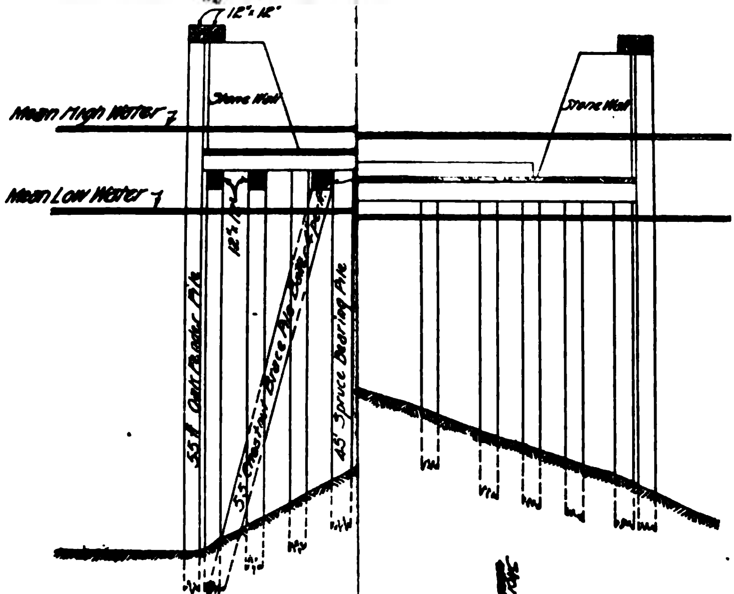
As stated above, this pier would undoubtedly have given good satisfaction and required only the renewal of fender piles and caps for a long period, if it had been properly constructed, and apparently this type should be an economical one where worms are not present to destroy the timber. No attempt has been made to describe the coal-handling machinery used in connection with this pier, as that is a separate matter.

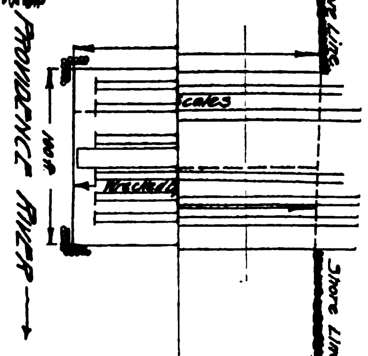
In connection with the general subject of "Construction and Maintenance of Docks and Wharves," it might be well to call the attention of such of the members as have not read it to the excellent article by Mr. Sidney W. Hoag, Assistant Engineer of the Department of Docks and Ferries of New York City, which was printed in the *Engineering News* of May 18, 1905. This article is fully illustrated and contains much information that should be of value to anyone interested in this subject.

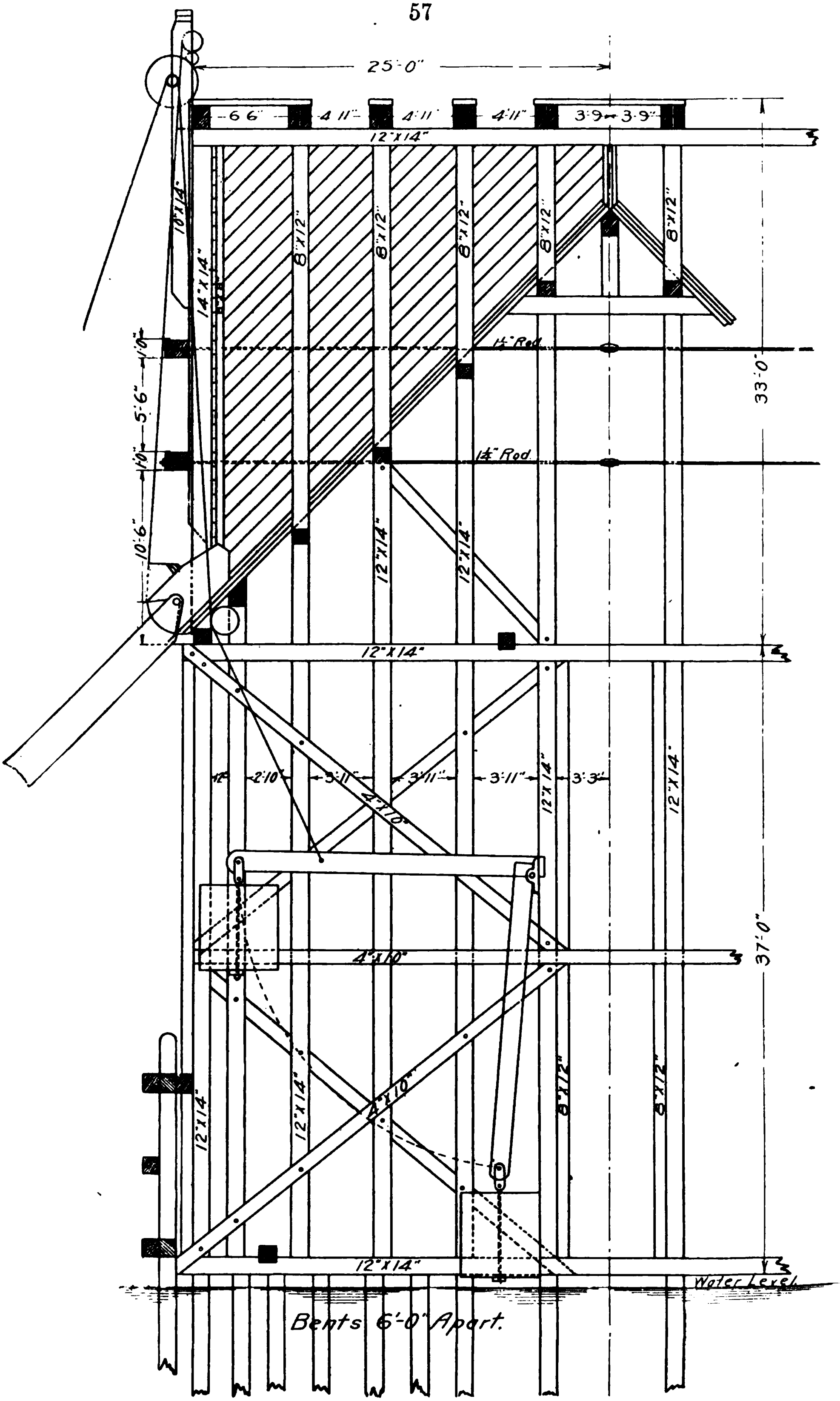
Yours truly,

J. S. Browne,
Division Engineer.


Mean High Water
Mean Low Water
Stone Wall
Stone Pier
Timber Tie


12" x 12"
Stone Wall
Stone Wall
Mean High Water
Mean Low Water
55' Oak Fender Pile
45' Spruce Bearing Pile


Shore Line
Shore Line
100 ft
PROVIDENCE RIVER


25'-0"
6'6"
4'11"
4'11"
4'11"
3'9"
3'9"
12"x14"
10"x14"
14"x14"
8"x12"
8"x12"
8"x12"
8"x12"
8"x12"
1¼" Rod
1¼" Rod
1'0"
5'6"
1'0"
10'6"
33'0"
12"x14"
12"x14"
12"x14"
12"
2'10"
3'11"
3'11"
3'11"
3'3"
12"x14"
12"x14"
4"x10"
4"x10"
37'0"
4"x10"
12"x14"
12"x14"
8"x12"
8"x12"
12"x14"
Water Level
Bents 6'-0" Apart.

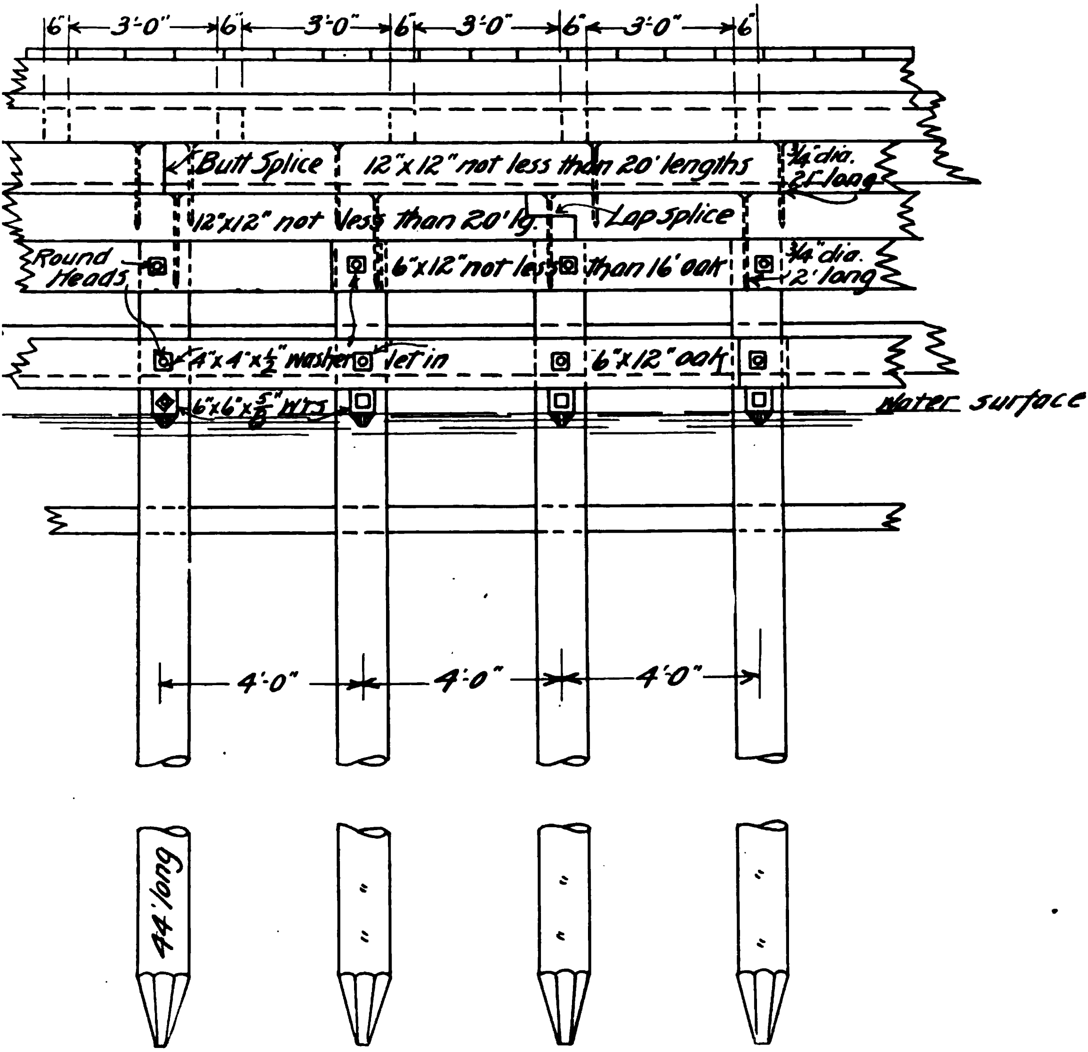


FIG. 6.—Double Cap Wharf, C., M. & St. P. Ry.

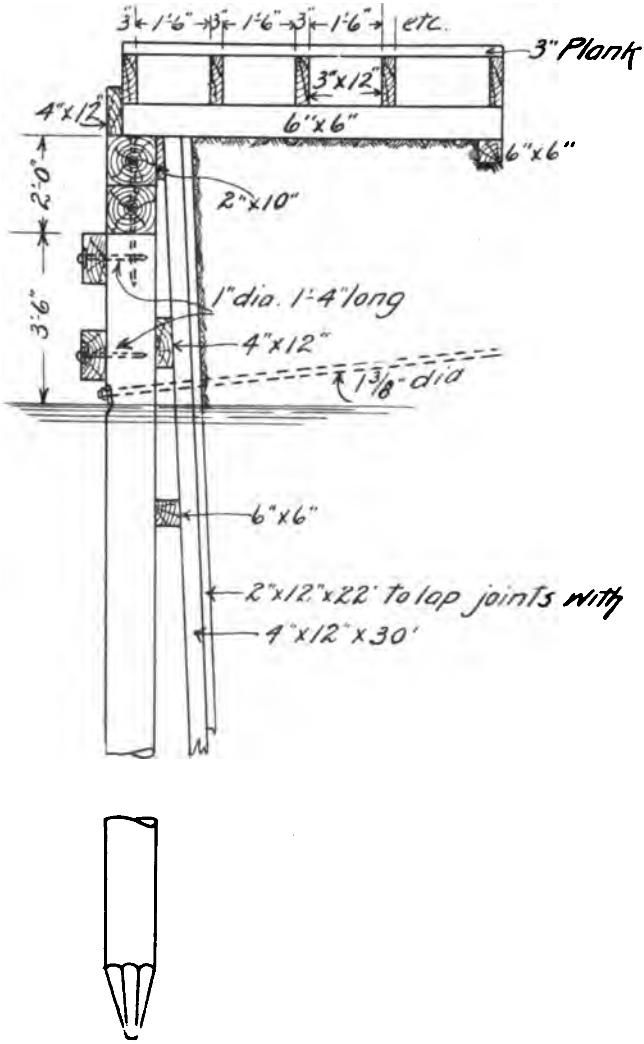
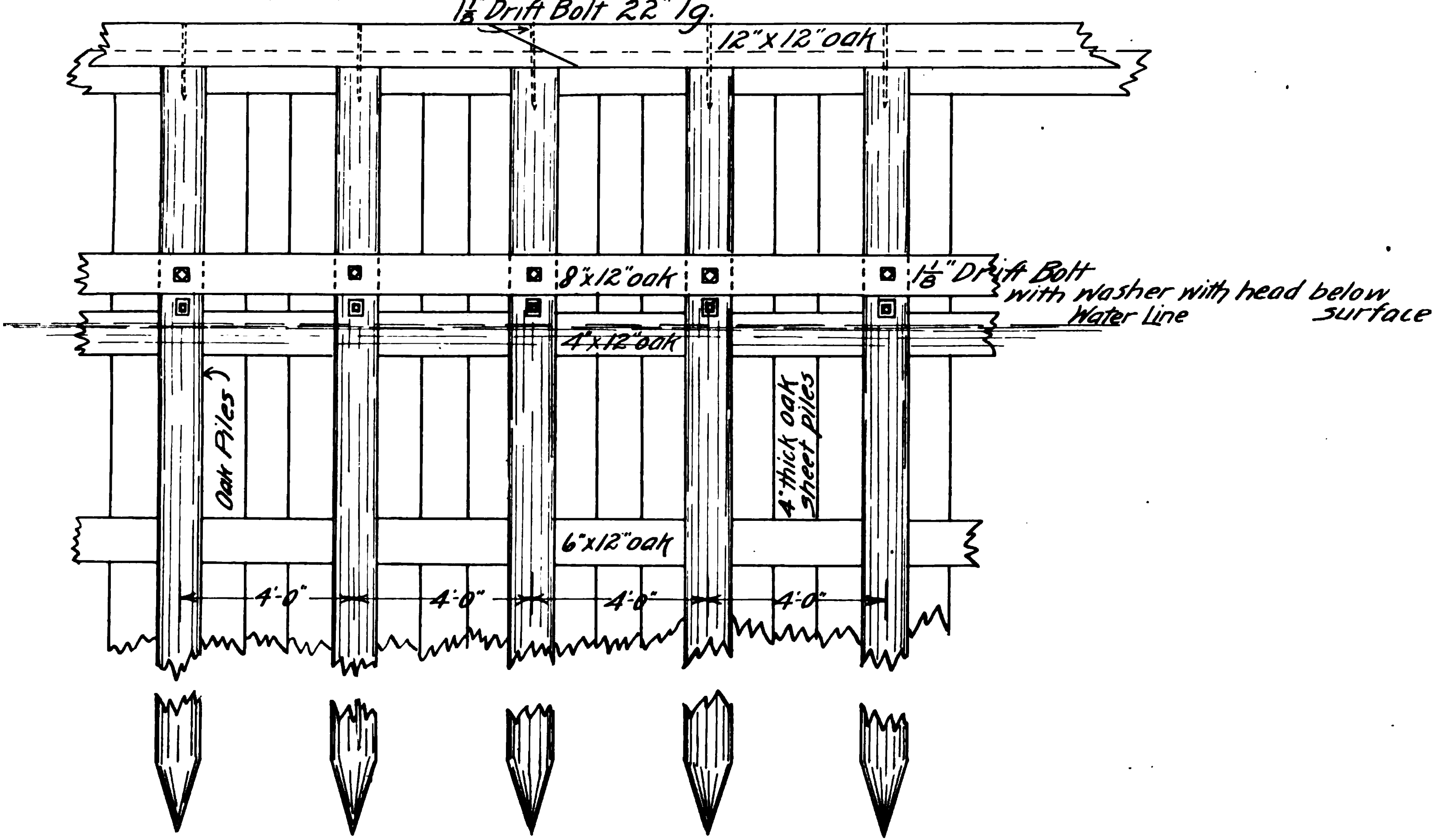


FIG. 7.—Double Cap Wharf, C., M. & St. P. Ry



FRONT ELEVATION

FIG. 8.—Single Cap Wharf, C., M. & St. P. Ry.

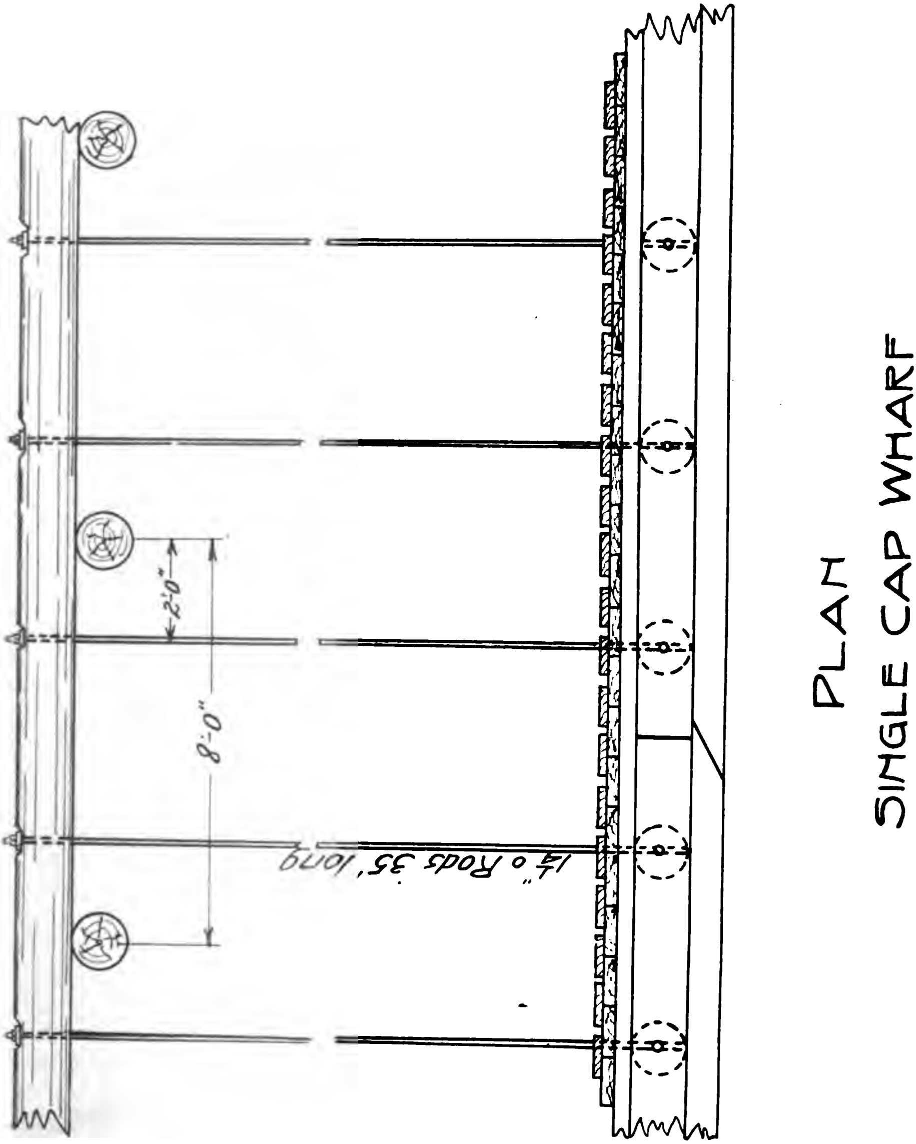


FIG. 9.—Single Cap Wharf, C., M. & St. P. Ry.

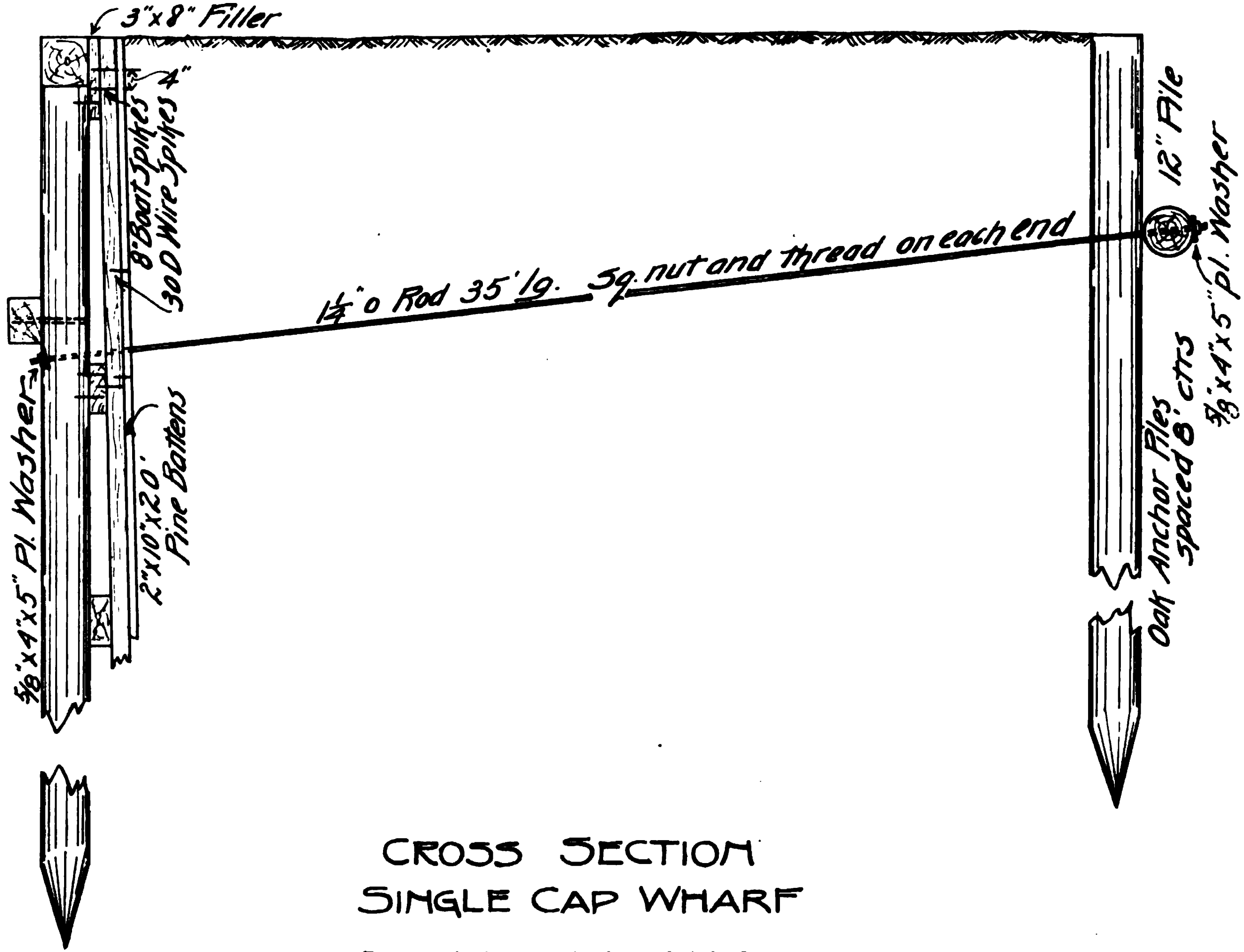
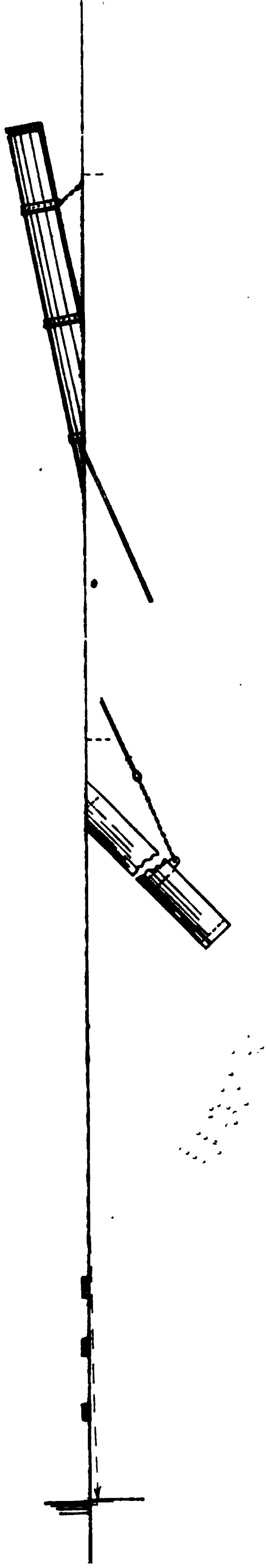


Fig. 10.—Single Cap Wharf, C., M. & St. P. Ry.



ESCANABA, MICH., September 8, 1905.

I have for many years been engaged in the repairs and building of ore docks and have found the present style to have a weak point in the use of what are called rafters, which are laid on top of the bottom of the pockets, and the partition posts set on top of the rafters and enclosed on both sides with planks, which makes a dead air space between the pockets and the moisture in the ore will go into the partition and rot the rafter and foot of the posts in a short time. In my plan this is remedied by placing the posts and timbers in the lower part of the dock so the partition posts can be run down to the purline plates, which will give them a square bearing and also give ventilation all through the partitions. In this way it will make the dock much stronger and also last two or three years longer.

My plan also shows an outlet door which takes in the whole width of the pocket and is so constructed that it can regulate the flow, from a fine stream to a full spout, and be closed in a moment when running wide open, if so desired. This is also provided with a platform, safe for the workmen to stand on to loosen up the ore in the outlet if it should become clogged.

The spout is fixed with a safety counterbalance, which fully controls the weight of the heavy spout and makes it possible to raise and lower the spout in half the time that is required with other counterbalanced hoists used heretofore and with less power. The drums are full faced and the cables have no chance to slip off and, therefore, it is safer to operate.

Yours truly,

L. J. ANDERSON,

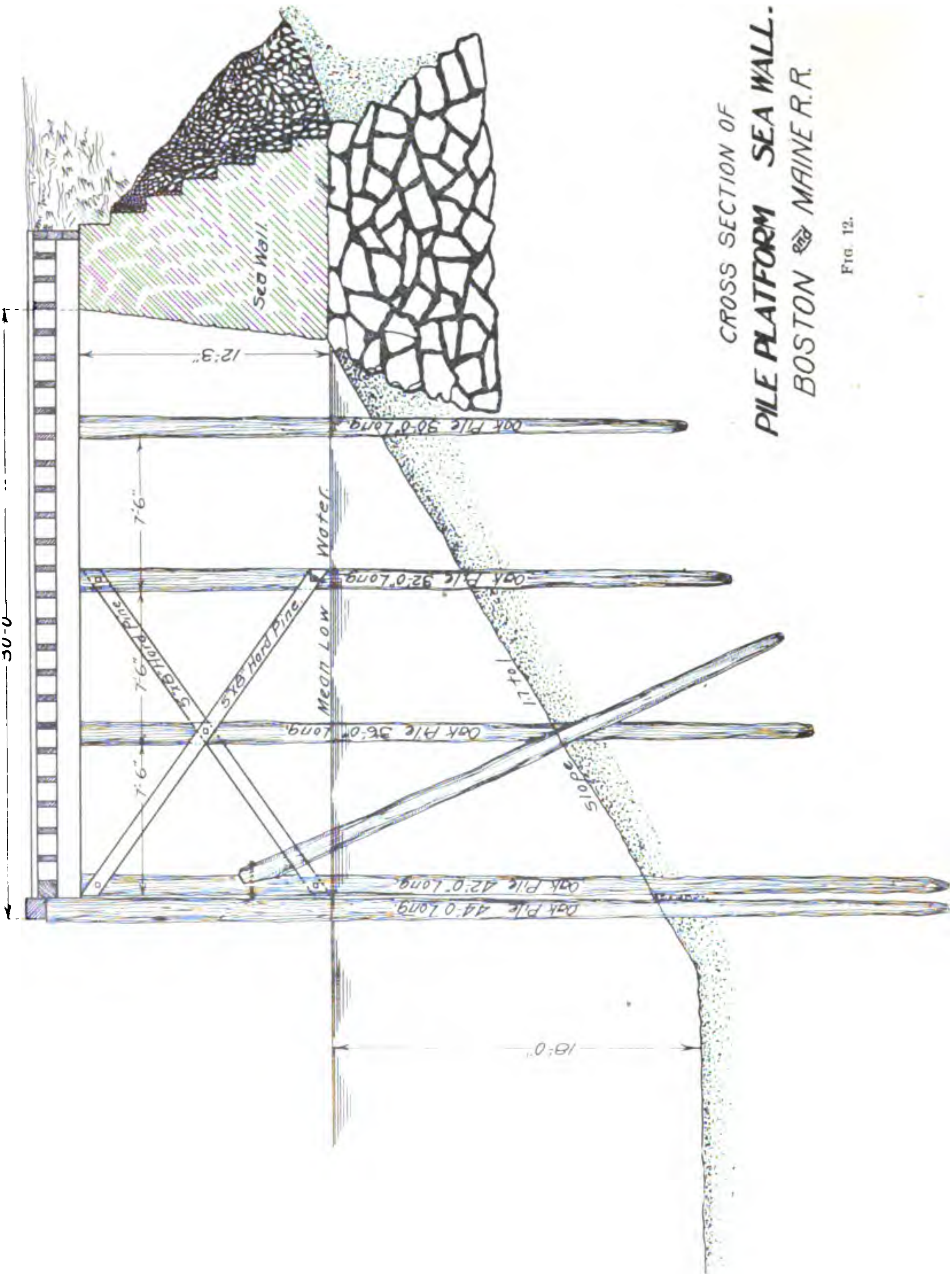
Foreman B. and B., Chi. & N. W. Ry., Escanaba, Mich.

DISCUSSION ON DOCKS AND WHARVES.

As the report says so little about tide-water shipping, I feel disposed to add a description of the salient points of difference between fresh and salt water constructions of this sort.

In the first place I wish to protest against the use of the word "dock" for the structure against which the vessel lies. I know that this use of the word is common in the western part of our country in ordinary conversation, but it is not good English and should not go into our proceedings, if we care to rank them as literature. In strict nautical *parlance* a dock is an enclosed water basin, either open to the sea or closed by a tide gate, in which vessels can lie while being loaded or unloaded. Such basins are a necessity at Liverpool, for instance, where the range of tide is 20 feet, or more. By extension, the term is made to cover any water space or berth where a vessel is tied up. The structure against which the vessel lies is a wharf or quay, if parallel to the shore, or a pier if projecting into the water so that the vessel lies more or less at right angles with the shore. Our chairman in his classification says, "Docks *and* Wharves;" and later speaks of "Docks *or* Wharves," so we are certainly at liberty to use the latter word if we wish.

The range of tide at Boston is about 10 feet; at New York about six; at Portland, Me., nine feet; etc. With a vessel riding



CROSS SECTION OF
PILE PLATFORM SEA WALL.
BOSTON AND MAINE R.R.

FIG. 12.

up and down twice each day to this extent the wales described in the report as forming the face on the front piles, are not admissable. Something would be sure to catch and, if this happened on a rising tide with no one by, the vessel might founder. The almost invariable custom is to face sea wharves with fender piles. These are capped with a 14-inch timber, wholly independent of the wharf structure; the only connection being a 1¼-inch bolt through each fender pile into the pile immediately behind it. The heads of these bolts are counterbored deeply into the fender piles to get them out of the way. On important wharves it is necessary to cut chocks between the fender piles, to prevent square-nosed lighters and such craft from knocking the fender piles out of place, lengthwise of the wharf. These chocks must in turn be well backed up with timber framed into the wharf, and should be set out a couple of inches so as to allow some spring when struck.

The plans of ore piers accompanying the report show pile faces so built as to have more or less spring. This is accomplished in sea-wharves by butting the cross-caps against the fender piles near the top and leaving the rest of the pile clear of the wharf framing. The bilge of a vessel is well below the rail and if a log float fender is used the piles will furnish ample spring to protect the structure from shock.

A favorite method of building wharves, and sometimes piers, around the New England coast is to build a stone sea-wall at low-tide water mark; and a pile platform outside it, wide enough to allow dredging to the required depth, with a stable slope, that will not undermine the wall. The piles are generally oak, the caps at right angles to the wall and eight to 10 feet apart. The top of planking is generally four to five feet above high tide and earth is filled behind the wall to the plank level. The walls are generally laid without mortar, as if laid up comparatively water tight the ebb and flow of the tide is liable to cut under the wall at weak points; whereas, if the masonry is open, it will flow in and out without damage. The back-filling immediately against the wall should be cobbles or gravel, so as not to wash out readily.

A typical cross-section of a wharf built as above is submitted. Many miles of similar structures exist on the water-front of Boston and nearby ports.

Transatlantic steamers, with bulwarks 20 feet and more above their water-line, require rugged structures to tie up to, and corners of piers require special treatment. As our author says, the subject is one well worthy of future study and our Association does well to put it into the hands of a standing committee. It may not be of great interest to some inland roads, but our Great Lakes, our long sea front and our navigable rivers call for a multitude of structures of the kind; and we can learn much from each other's practice, although each class of navigation and each kind of water has requirements and conditions of its own, different from the rest.

J. P. SNOW,
Bridge Engr., B. & M. R. R.

DISCUSSION.

Mr. Rettinghouse.—I have said about as much as I know in this report. I want to say for the information of the members that owing to a large amount of work I have not had the time to give this report as much consideration as I should like to (our president is in a position to verify my statement; he has been a close neighbor of mine for the last six months). I came on a new division, a new field altogether, and being thrown into the midst of a whole lot of work, it was simply impossible for me to do anything of any value about this report. I sent out circulars and I am quite sure I sent one to Brother Cummin, although it may not have reached him; also to Mr. Killam. The mails of the United States and Canada must be in very poor shape. I guess the next time I will send them by railroad mail and maybe then it will reach them.

I took up the matter with the members of the committee and received some replies, but the only reply offering any suggestions or mode of procedure was from Mr. W. A. McGonagle, and I am very sorry he is not here at this time, as he certainly would be in a position to give us some valuable information, especially as regards ore docks. I do not think there is very much to discuss on this report, because there is not very much to it. I am of the opinion that the subject should be carried on and enlarged. The scope of it is so large that there is all kinds of opportunity to extend and expand on it.

As I said before, I have no reference whatever as to ocean docks. Since Mr. Cummin is such excellent authority on these docks, I should like to hear from him.

Mr. Cummin.—Mr. Chairman, what I want to say is that I do not wish it understood that my remarks were made in a spirit of criticism at all. They were not made in that sense. Now I noticed on the list of reports and the names of the chairmen, that there are some of them who have

never been chairmen of committees before, and they might not understand the way in which we formerly made out reports and got them into the secretary's hands. In regard to my friend Rettinghouse's remarks about my being authority on docks, I wish to take exception to that remark, as I did not mean any such thing, but had I received his letter I might have been able to furnish some information in regard to docks built along the Atlantic coast, and when I say the Atlantic coast, I do not mean the Atlantic Ocean. I refer to tide water. The dock department of the City of New York have plans already prepared, that is, standard plans, for their work on the North and East Rivers, and I think a copy of those standard plans printed in our proceedings would be of great benefit.

In the report given by the chairman of the committee, he gives the length of docks and the cost per lineal foot, but I did not hear anything about the width or the height of them, and in regard to the prices of material, I think it should be stated where and in what portion of the country that material can be bought for those prices. I think those portions of the report should be made clear as to the location of these docks. Now you take the managers of the roads,—they read of one person getting material for $21 to $25 per 1,000, large timber for docks, which our purchasing agent cannot get for less than $35,—they might thing there was a screw loose somewhere.

Mr. Rettinghouse.—In regard to Mr. Cummin's remarks as to the location of the work in question, I think I gave the location of the docks of the D., M. & N. Ry., at Duluth, Minn.; the D. & I. R. Ry. at Two Harbors, Minn., and the W. C. Ry. at Ashland, Wis. I have also referred in my report to a list giving all the dimensions of the ore docks on the Great Lakes. This list is attached to the report, but there is so much of it that I did not think it worth while to read it, thinking that the report would not be discussed this year on account of incompleteness. I do n't think it should be published in the proceedings this year, but would

be a good subject to be discussed at a future meeting. However, for the information of Mr. Cummin, I will say that the width and height of the docks in question are as follows: D., M. & N., Duluth dock No. 3—number of pockets, 384; storage capacity, 80,640; height of dock from water to the center of hinge, 40 feet, seven inches; height from water to deck of dock, 67 feet, one half inch; width from outside to outside of partition posts, which means width in the clear, 59 feet; length of spouts, 27 feet, nine inches; length of dock proper, 2,304 feet; angle of pockets, 45 degrees. In referring to length of dock, that part of dock is only figured which has pockets. Every ore dock has more or less of an approach, which cannot be very well considered in this report on account of their variation in lengths to approaches. The D. & I. R. at Two Harbors, dock No. 5—Number of pockets, 168; storage capacity, 33,600; height from water to center of hinge, 30 feet; height from water to deck of dock, 54 feet, six inches; width, 49 feet; length of spout, 27 feet; length of dock, 1,042 feet; angle of pockets, 38 degrees, 42 minutes. The Wisconsin Central at Ashland, Wis., dock No. 1—Number of pockets, 314; storage capacity, 48,356; height from water to center of hinge, 40 feet; height from water to deck of dock, 66 feet, two inches; width, 36 feet, one inch; length of spouts, 27 feet; length of dock, 1,908 feet; angle of pockets, 50 degrees, 45 minutes.

In addition to this the list I refer to gives a complete record of all the ore docks on the Great Lakes. As to Mr. Cummin's reference to the plans of the City of New York, Mr. J. S. Browne, a member of the committee, wrote a letter describing in detail the construction of the Wilkesbarre pier. He gives a number of figures and if it is the pleasure of the Convention I might read the letter.

(See letter from Mr. J. S. Browne, which was thereupon read by Mr. Rettinghouse.)

Mr. Rettinghouse.—You will note he speaks of pulling old piles at $4 each. I would like to have some man come up to pull some piles for me at that price.

Mr. Cummin.—I wish to say that I was misled in this

subject. Now the subject as I read it here was the "Construction and Maintenance of Docks and Wharves." I took it for granted that it was what we would term a dock or wharf where a steamer or vessel of any description loads and unloads, but the report deals altogether with ore docks.

Mr. Rettinghouse.—Those docks were included in the first part of the report that was read. It was the second part of my report that referred to ore docks, and I stated in the report that we deferred the investigation of ocean docks to some future time, as on account of no knowledge of them we must of necessity eliminate that part of the subject and confine ourselves to inland lake docks. Therefore, the report is specifically confined to merchandise and ore docks. The first part of the report referred to just that class of docks and wharves that we reported on.

Mr. Cummin.—Then you eliminated that portion of it, did you?

Mr. Rettinghouse.—No, I did not. I don't think you paid very close attention to the reading of the report.

Mr. Schall.—The question that is bothering me is, What was the cost of the lumber? The cost stated by Mr. Rettinghouse, I believe, is $28 per 1,000 feet in place, including labor.

Mr. Rettinghouse.—That was on pine or Oregon fir.

Mr. Schall.—We have to pay more than that for the material, Southern long leaf yellow pine. I think the report should state that the material upon which the cost in the report is based is Northern pine, in order to give myself and others a correct idea as to the cost of such work. Our costs much exceed those quoted by Mr. Rettinghouse.

President.—I wish to make a remark that might come in line here. I think, Mr. Schall, that the chairman has given you the location of these docks and the kind they are and there has also been some blue prints furnished. I will say for your information, as well as for Mr. Cummin, that the Chicago & Northwestern Railway pay for pine lumber $15.50 to $21, and also get fir lumber from the coast at $8, plus the freight, but I do not know what the freight is.

So the price varies greatly in the different localities, but as long as you get the locality or the location of a dock or wharf, I think that part in regard to the price of material will take care of itself. We figure material in place at from $25 to $30 per 1,000 in Wisconsin.

Mr. Rettinghouse.—The price of fir timber delivered in Wisconsin at this time, I believe, is $21.50 per 1,000 for any such length that can be loaded on one car, up to say 34 feet or 36 feet long. As soon as you go over that length the price is a great deal higher. The ordinary stringer stuff and caps used for pile bridges varies from $21 to $22 per 1,000, and has been the same for the last two years.

Mr. Montzheimer.—I think a good plan would be for Mr. Cummin to get a set of the plans mentioned and have them sent to our secretary to be printed in the proceedings. That is, possibly not all of them, but those most important.

President.—I would suggest that Mr. Cummin try and furnish the chairman with the plans, if possible.

Mr. Cummin.—I will gladly do that, Mr. President.

Mr. Killam.—I might say that I have listened with considerable interest to what has been said, but I regret very much that a report of that importance was not printed and in the hands of the members here, because it would have been so much better understood. Mr. Rettinghouse stated that he did not get replies to his circular letters from his Atlantic Ocean friends, and I am like some of the others,—I did not get his letter. There must be some faulty mails in his part of the country, back there in Wisconsin. I do not know why I did not receive his letter. I have had other letters from him, but this one appears to be the only one I did not get, or I could have told him something about some of the docks we have in our part of the country, because we have docks, wharves and structures of that character that cost very large sums of money to build. Different kinds of material have been pointed out, but you cannot tell in making an estimate at one place what it is going to cost to perform that work in another place. Everything has to be guided by circumstances. But for the information

of the members, I would state that we get for our docks, for the stringers, such as 12 x 16 hard pine, somewhere in the neighborhood of $28 to $35 per 1,000, 30 to 40 feet long and sometimes 50 feet long; shorter lumber costs less.

Mr. Penwell.—I think Mr. Rettinghouse's report is quite clear in regard to the price of material. Now he gives us the cost of a certain dock and the cost of material at a certain price. If they get material in that locality at that price, and we have to pay more in another locality, you have only to add in the difference in the cost of this material to arrive at the cost of a similar dock. I for one feel very well satisfied and I want to compliment my brother here on the report he has gotten out; I think it is full of information.

Mr. Cummin.—I may owe Mr. Rettinghouse an apology, because I never saw a dock built like that in my life.

Mr. Steffens.—Mr. President, only in explanation of what has been said, I just wish to say that that article in the *Engineering News* by Mr. Sidney W. Hoag, assistant engineer of the department of docks and ferries of New York City, is a very extensive, practical treatise on dock and wharf construction in New York City, and any discussion in this organization could not add to the value of that report.

Mr. Cummin.—I would like to ask Mr. Rettinghouse one question. In building his docks as per the blue prints submitted, do you have to get permission from the authorities to build them?

Mr. Rettinghouse.—In what respect?

Mr. Cummin.—Why, get a regular permit to build them, the same as you would to erect any building in a city.

Mr. Rettinghouse.—The permits are based only on the dock lines established by the government. You have got to keep within them.

Mr. Cummin.—If you do not have to furnish a full set of plans and get a regular permit from the dock department, you are better off than we are. We cannot build a dock without first getting up the plans and specifications

and having them thoroughly examined by Mr. Sidney W. Hoag, assistant engineer, department of docks and ferries of New York City, and his assistants before we can get a permit to erect them; and without criticising that plan whatever, because I never saw one built like it, you could n't get a permit anywhere in New York to erect a dock of that description. That is why I say you are better off.

Mr. Steffens.—The Eastern men have one conception of a dock or wharf and the Western men have another. In New York City, the water front being owned largely by the city, the difficulty Mr. Cummin speaks of is experienced by all railroads doing business there. Our structures in New York City are largely of a pile and timber variety; that is, of frame-work supported on piles.

Mr. Rettinghouse.—Again referring to the question of permit, I would like to know from Mr. Cummin why he could not get a permit for that class of a dock.

Mr. Cummin.—For the simple reason that the engineers would not pass it.

Mr. Rettinghouse.—How much water do you have there?

Mr. Cummin.—Fourteen feet in some places at low water and the average tide is four to five feet.

Mr. Rettinghouse.—I do n't see why it would not answer.

Mr. Cummin.—I say you could not get permission to. The dock department have certain set forms and rules and they would not allow you to deviate from them. In addition to sending the secretary their standard plans for docks, I will also send plans of the different forms of cribs.

Mr. Rettinghouse.—I have a plan here of the Chicago, Milwaukee & St. Paul, which is their standard, and you will see that it is virtually the same construction.

President.—Any further discussion on this report? If not, we will pass to subject number two, "Relative Value of Concrete and Timber Piles."

(No report.)

President.—As there is no report on number two, we will pass to subject number three, "Concrete Building Construction, Including Platforms."

III.

CONCRETE BUILDING CONSTRUCTION, INCLUDING PLATFORMS.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

The use of concrete in building construction does not appear to have received the attention in railroad work which is its merit. A canvass of the various railroads of the country shows that with few exceptions its use has been confined to retaining wall, bridge pier, arch and platform construction.

A list of questions pertaining to the best practice in concrete building and platform construction was mailed to numerous members of the Association and the answers received show that the use of concrete for building purposes on the various railroads has been very limited. The use of concrete for station platforms, however, appears to have the approval of all.

In the preparation of this report the use of concrete for station platforms will be taken up first and the practice of our members compiled into a specification for the construction of a good concrete platform, together with their experience in its use.

The selection of concrete for platforms depends largely on the importance of the station, as its use is not recommended except at terminals and important way stations.

A concrete platform having been decided upon, the first step in its construction is the foundation. Excavation for foundation in most cases should be made to a depth of 15 inches below top of proposed platform height, arranging the bottom so that any accumulation of water under the platform will readily drain off. At locations where an excess of water is expected, porous tile drains should be provided as an additional precaution, spaced about 10 feet apart and arranged to drain into a sewer. A bed of coarse cinders or broken stone should then be laid to a depth of 10 inches and well wet and tamped. This will bring the surface to within five inches of the grade desired for the platform. The above specification for foundation applies particularly to climates where frost occurs and to locations having a soil of clay formation. The excavation for foundations need not exceed 10 inches and the foundation course need not be greater than four inches in the warm southern climates not affected by frost and locations having a porous sandy soil, which readily drains off the water.

The concrete base for the platforms to be spread on top of the foundation course and well tamped to a uniform thickness of four inches. The materials for the concrete to be cement, sand and gravel or broken stone in the proportions of one, three and five. The proportions given are those recommended by the majority in their replies. Good results, however, are obtained by the use of a mixture of one, two and four, or one, two and five.

The substitution of broken stone for gravel is a matter of location and cost. In either case the largest piece to be of a size that will readily pass through a one-inch ring. The gravel or broken stone to be free of dust, loam or other foreign substance. The sand to be clean and sharp and free of loam. Sand best suited ranges in size from a very fine to a size approaching a fine gravel. For cement most of the American Portlands will give entire satisfaction.

In mixing, the materials in concrete are more thoroughly incorporated by the use of a mechanical mixer, but the yardage is usually so small that its use is not warranted. To make a good mixture by shovel the following method is recommended by the majority: Provide a platform of boards or plank of sufficient size to mix a yard of concrete, this being the maximum amount to mix in each batch. Spread the sand evenly on this platform and then cover with cement in the proper proportion. Mix thoroughly until of a uniform color, then add water necessary to make a thin mortar and spread again. Add the gravel or broken stone and mix thoroughly until all has a coating of mortar. This will usually require the mixture to be turned four times. Another method of mixing and one which can be recommended by your chairman as quick and efficient, is to spread the gravel or broken stone uniformly over the platform, cover with sand in the desired proportion and then cover with cement spread uniformly in its proper proportion over the sand; all to be thoroughly mixed while dry. Water is now sprinkled over the mixture and the whole mass turned again thoroughly. Water to be added during mixture until concrete is of desired consistency.

After being thoroughly tamped, the concrete base should immediately be cut into uniform blocks or squares of a size not exceeding five feet. The size selected to be laid out and plainly marked on the confining curb or form and the lines established by straightedge or string. The cuts forming the blocks to be made with a knife-bladed tool and must extend clear through the base. The cut formed by the blade should be about three eighths of an inch wide and must be filled at once with dry sand. In laying out and making the cuts, the surface of the base should be protected from footprints by using boards or plank properly raised above the surface.

As each mix of the base is applied and properly cut, it must be immediately covered with the top or wearing surface. The hardest and best wearing top surface is formed of one part Portland cement to two parts limestone, granite or other hard stone screening. The screenings to be fine and contain about 30 per cent. of the stone dust. The materials for top coat to be spread on the mixing platform, one over the other, and thoroughly mixed while dry. Water is then added only in such quantity as will make a plastic mass. After being thoroughly mixed the top coat is spread over the base and worked down to a uniform surface and to a thickness of one inch. It should never be tamped, but must be worked down hard with "floats." After working with a float a plasterer's trowel is to be used until the surface is worked even and smooth.

With a string or straightedge, using the marks previously made on the curbing or form for use in cutting the base, the surface is to be laid out and cut in squares, directly over the cuts

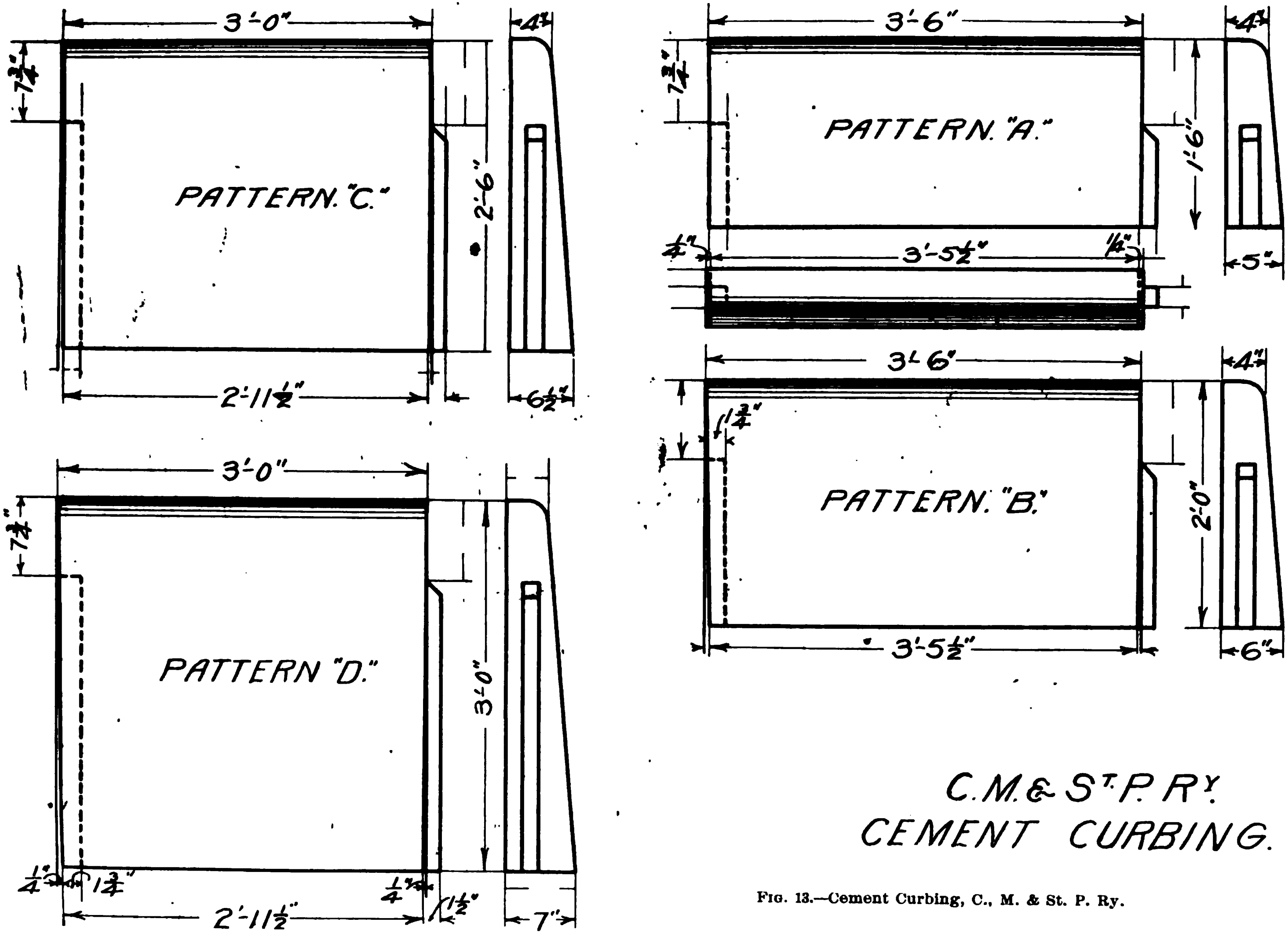


Fig. 13.—Cement Curbing, C., M. & St. P. Ry.

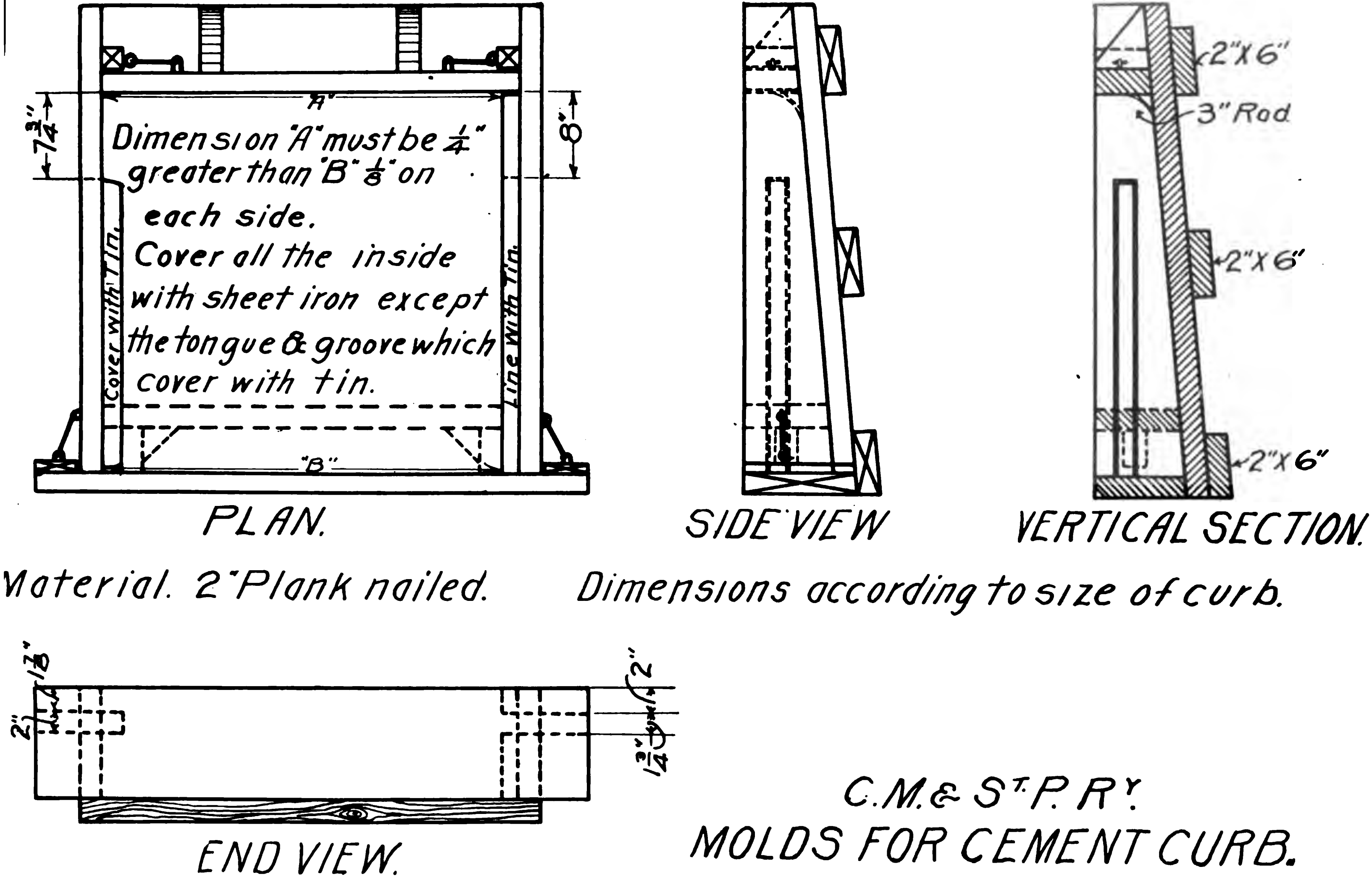


FIG. 14.—Molds for Cement Curb, C., M. & St. P. Ry.

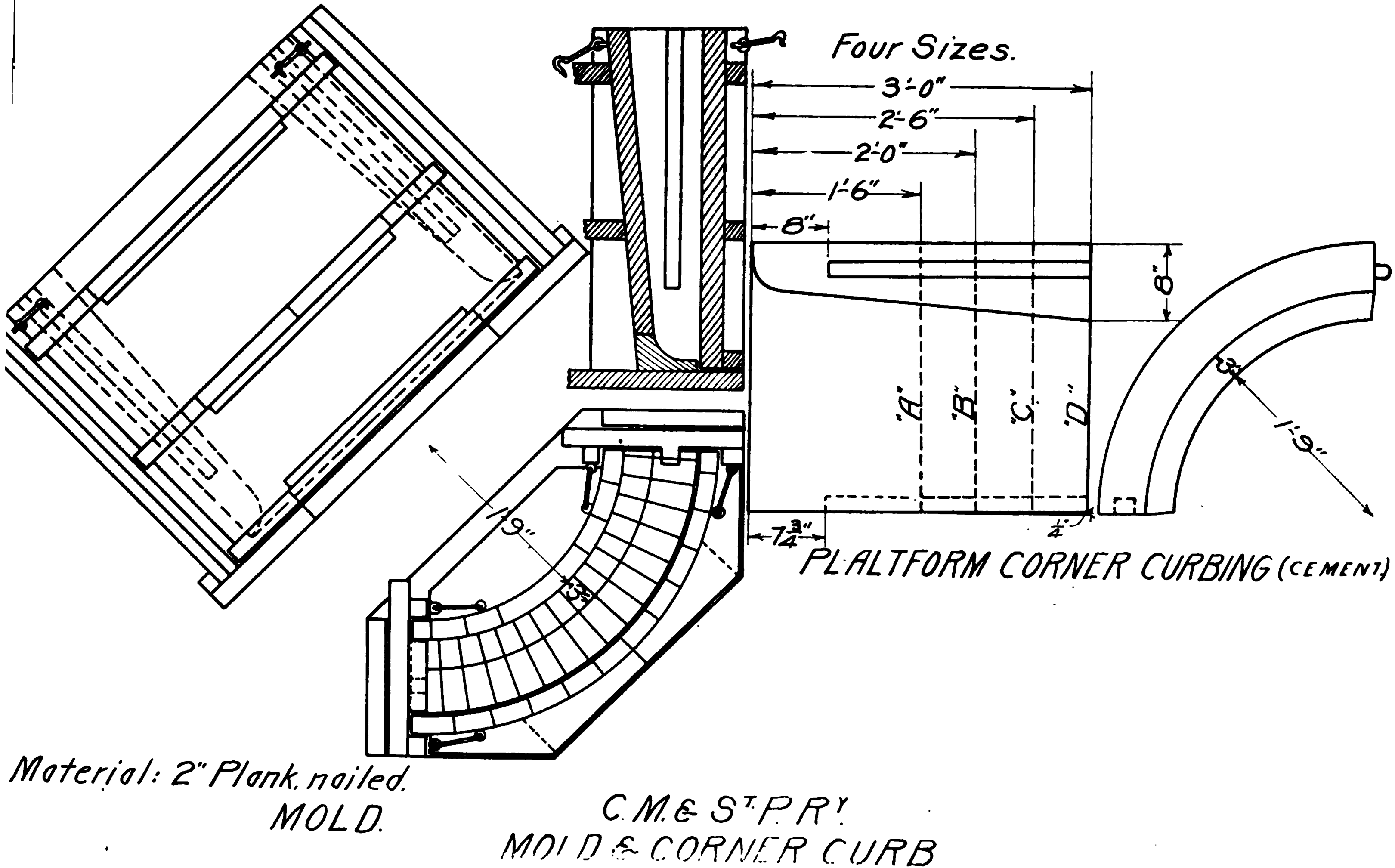


Fig. 15.—Mold and Corner Curb, C., M. & St. P. Ry.

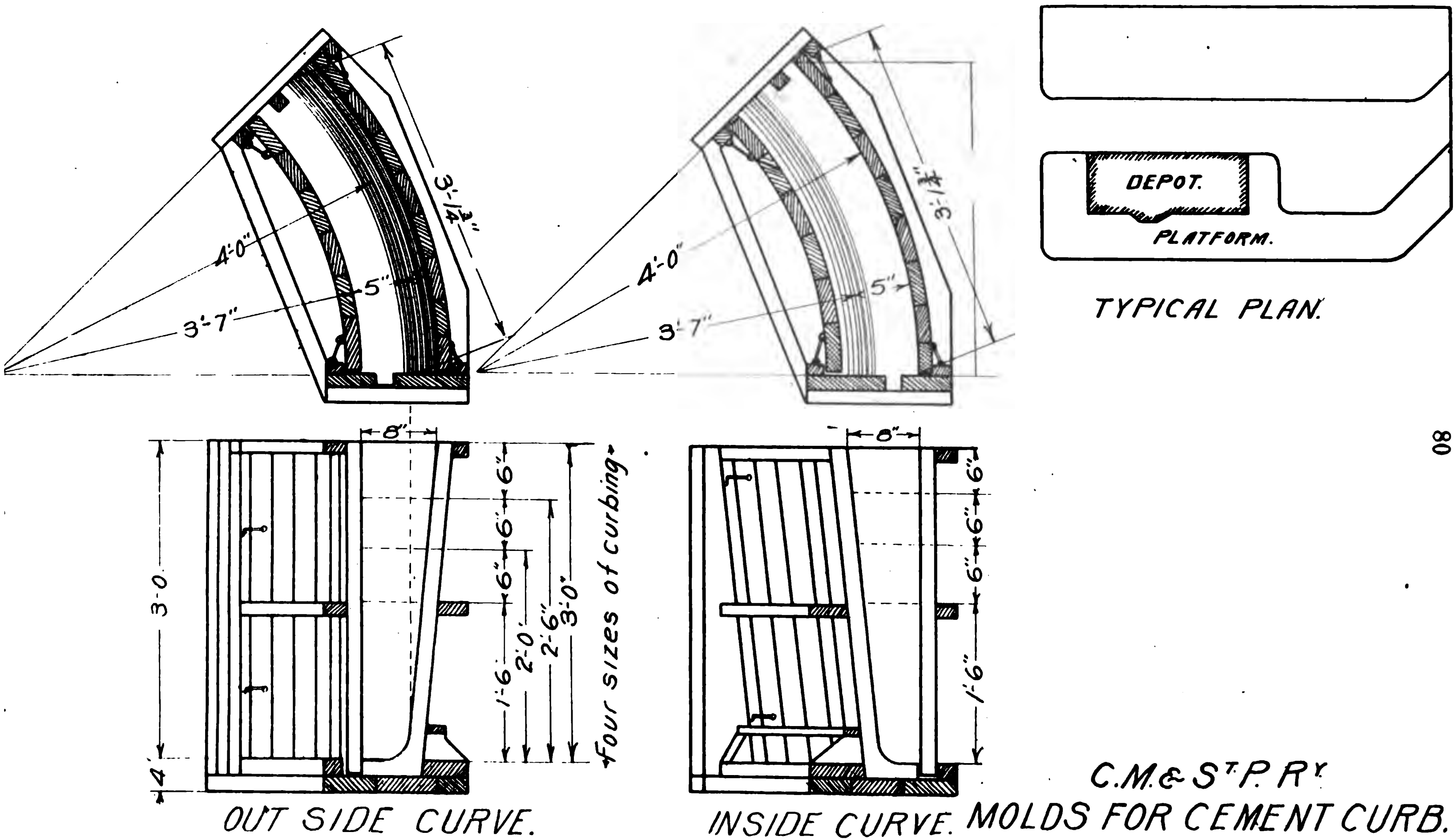


FIG. 16.—Molds for Cement Curb, C., M. & St. P. Ry.

made in the base. Care must be taken that these cuts extend through the top surface into the cuts in the base. The edges of the cuts are to be beveled or rounded with an edging tool. If desired, the surface may now be roughened by the use of a dotting roller.

The edges of platforms paralleling the railroad tracks and driveways should be protected by curbing. This curbing may be formed of stone or concrete and may be set before building the platform, or built as a part of it. Very good results are obtained from concrete curbing formed in molds and set before work on balance of platform is started. The curbing should be formed in lengths corresponding to the size blocks into which the platform is to be cut. The joints in the curbing and cuts in the platform normal to it should coincide. The concrete base and the top surface of platform should be kept from direct contact with the curbing; joints to be made between the two in a manner similar to the cuts or joints in the platform proper. Edges of the platform abutting the earth or grass plot to be formed by wood form, as a curbing is not necessary.

Plans of a good concrete curbing as used on the C., M. & St. P. Ry., together with the plans of the molds for its manufacture, have been furnished by Mr. C. F. Loweth and are herewith attached as Figs. 13 to 16, inclusive.

The height of curbing above top of rail and its distance from gauge of rail are variable quantities, as no two railroads use the same dimensions.

The pitch of platforms, all agree, should be from one-eighth inch to one-quarter inch in one foot, inclined away from the tracks. Cement walks four to six feet in width should have the concrete base formed from two to three inches thicker at the center than at the edges; this to prevent the walk from cracking down its center, due to the frost raising the edges of the walk.

The following points must be closely observed in the fabrication of a cement platform:

Do not allow any portion of the concrete base or top surface to come in direct contact with the curbing, building, post or other object, as expansion and contraction in these will cause cracks in the platform. Provision must be made to separate them with dry sand joints or with tar paper.

See that the roots of trees are removed from under platforms, as they cause bad cracks by upheaving the platform.

Do not allow the concrete base to be mixed with an excess of water, as the tamping will bring this water to the surface and prevent a bond with the top or wearing surface.

Do not lay a concrete platform in freezing weather unless absolutely necessary. When compelled to lay a platform in freezing weather such precautions as warm water, warm sand and gravel and a good protective covering will usually insure a good platform, but in general it is bad practice.

Inquiry as to the condition of a cement platform in frosty weather and in snow storms develops a diversity of opinion. Some claim it is not affected, while others say it is dangerously slippery. Mr. C. F. Loweth, one of your committee, states that the C., M. & St. P. Ry. do not use concrete platforms, for the reason that they consider such platforms objectionable in frosty weather on account of their slippery tendency. He also states that they

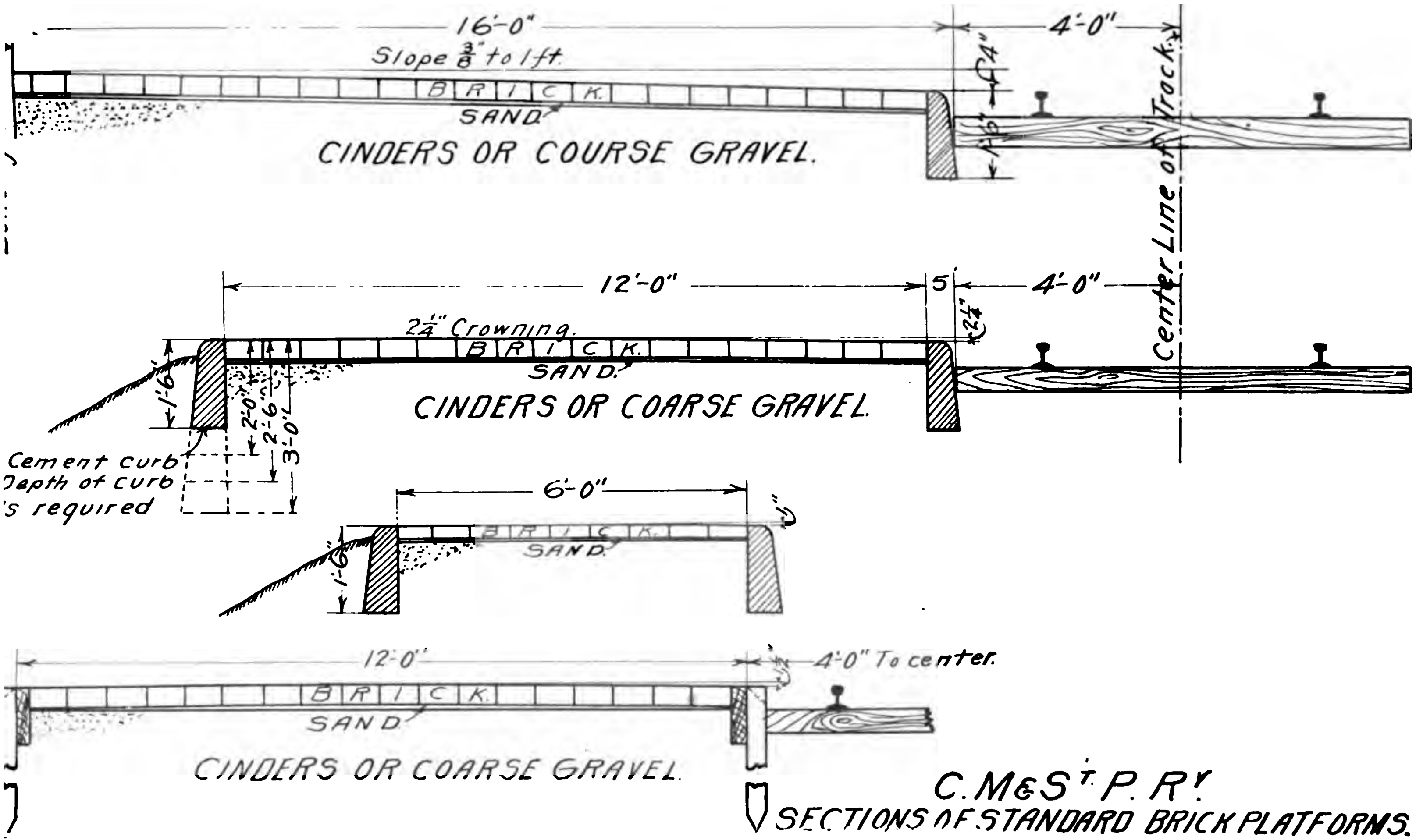


FIG. 17.—Sections of Standard Brick Platforms, C., M. & St. P. Ry.

have adopted vitrified paving brick as their standard platform at all stations.

The matter of cost, the most important factor in any platform, is a good conclusion for the subject. According to replies received, the cost ranges from 12 to 20 cents per square foot, including foundations.

CONCRETE BUILDING CONSTRUCTION.

While the use of concrete for building purposes has the approval of a large number of our members, the experience of the majority is restricted to its use for other purposes. However, they recommend its use in the construction of vaults, oil storage houses, shops, engine houses and, in fact, the majority of the shop buildings at terminal points.

The general design of a concrete building will be determined by its location and the purpose for which it is to be used. For small, unimportant buildings, hollow concrete blocks may be used to a decided advantage in the construction of the side walls. The roof of such buildings to be of reinforced concrete slab construction, its thickness depending on the span and general construction. The subject of roofs will be discussed under its proper head in this report. Buildings of any size or extent are designed in numerous ways. The walls may be constructed of uniform thickness and as monoliths. The roof load to be supported at proper intervals on this wall.

Another method, and one which conforms to good engineering practice, is to support the floor and roof loads on posts or columns constructed of sufficient number and size of reinforced concrete to carry the load; the space between the posts to be formed into these curtain walls by using reinforced concrete properly bonded to the posts.

It is not the intention of your committee to go into a lengthy theoretical discussion on concrete buildings, but rather to confine this report to such practical points on their construction as experience has taught are good. With this in mind, we will start at the foundation of a concrete building and discuss the various stages to its completion.

The excavation for foundations of a concrete building are made as in any other building and practically the same means used to secure their stability. By using proper reinforcement in the foundations, they may be made of shallow depth, providing, of course, the bottom is below the frost line.

If the foundation is designed to carry a wall in which expansion joints are to be used, such joints must be carried down through the foundation. The foundation for a monolithic wall such as used in engine house construction may be formed of a footing course of reinforced concrete two feet to two feet, six inches in width, and about 18 inches deep, placed below frost line. The building wall to be carried up from this footing course and from the foundation to the surface of the ground.

Foundations for columns, while they require a sufficient area to properly distribute their load may be formed of a reinforced concrete slab without the usual steps back from footing course to column base. Thus excavation to a less depth is required. The

walls, if constructed as monoliths, will not require expansion joints, if proper reinforcement is provided vertically and horizontally to take care of temperature stresses. Walls of buildings constructed after this method may be run to an unsupported height of 20 to 25 feet, with a thickness of 12 inches. If the building is built on the lines of a modern steel structure, substituting reinforced concrete throughout for steel work, the walls need not exceed a thickness of from three to six inches and may be formed of concrete blocks or reinforced concrete. In numerous cases these curtain walls have been constructed by using expanded metal as a reinforcement and applying the concrete to a thickness of from two to three inches with a plasterer's trowel without the use of any form whatever.

Door and window openings in the concrete walls are formed in much the same manner as in a brick building; that is, by placing the door or window frames in the forms and building the concrete around them.

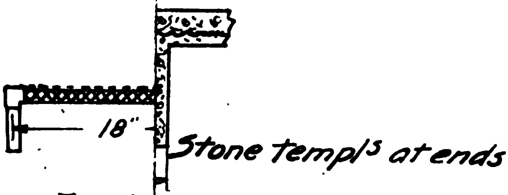
In constructing the walls it has been found that by depositing the concrete in layers of from six to nine inches in thickness, much better results are obtained. Each succeeding layer to be deposited before the one before has taken its initial set. When work must be suspended at night, the surface of the last layer must be washed off with water and coated with a thin grout before the next layer is applied in the morning. This will assist in forming a proper bond between the layers and at the same time will prevent the very perceptible joint which would otherwise show in the finished wall.

In the construction of a building with reinforced concrete columns, floor girders, etc., the outside columns are to be formed square, to conform with the outside face of wall and arranged so as to form pilasters. The inside columns, or posts, may be either square, octagonal or circular. In all cases proper vertical reinforcement must be provided. For the square or octagonal columns, rods are to be placed in the concrete at each of the angles, all secured to each other horizontally with proper metal fastenings. The size of the columns in all cases will depend on their loads and unsupported height.

The forms for main floor girders are to be framed into the column forms and the reinforcement run from one to the other in such manner as will properly take care of the end shear in the girders. The concrete forming the girders and the column tops to be deposited at the same time, so as to make the two a homogeneous mass.

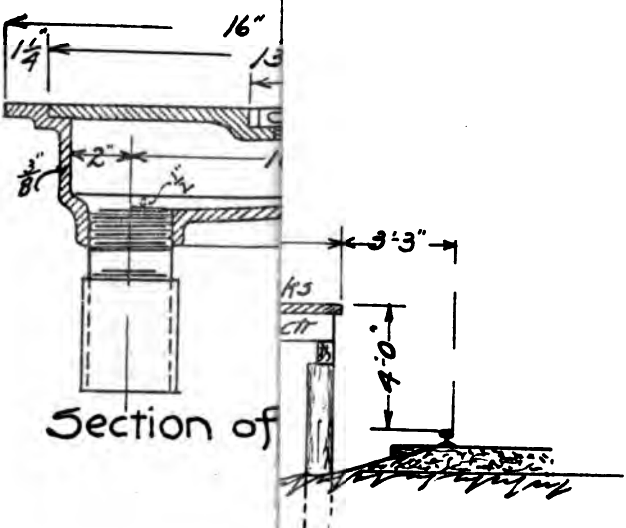
In the construction of concrete girders, care must be taken to complete the span once it is started, as any interval between the batches of concrete long enough to permit an initial set in the preceding batch is liable to cause a joint in the girder.

The dimensions of the floor girders and their reinforcement are dependent on the loads they are designed to carry. They are usually spaced from 20 to 30 feet apart and the floor carried on intermediate concrete girders. The intermediate girders are usually spaced from 12 to 16 feet centers. The floors may be formed of a solid slab construction or of a hollow tile construction with ribs of reinforced concrete between each row of tile. In both cases the thickness of floor and its reinforcement depend on its span and the load it is designed to carry.



Front

DETA



Section of

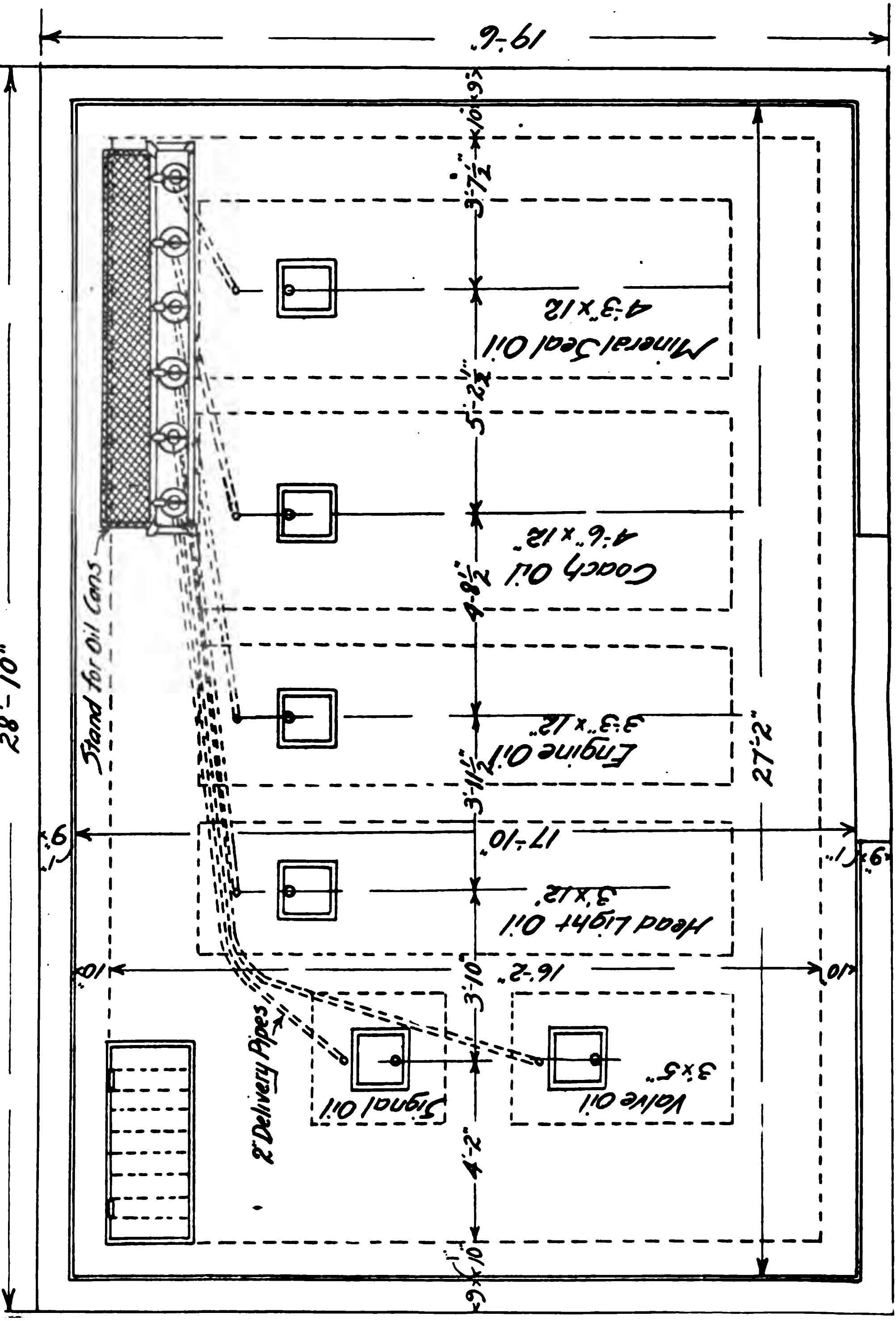
The roof may be designed of concrete girders and purlins in the same manner as the floor, or if designed with a pitch, steel roof trusses are provided to carry the roof. When the roof covering is formed of concrete, the steel purlins may be omitted altogether if the trusses do not exceed 20 feet centers. If the distance between trusses is greater than 20 feet, steel purlins are to be provided at intervals of eight or 10 feet, to properly carry the roof covering. The concrete roof covering is formed of reinforced concrete in a manner similar to the floor construction. Cinders may be substituted for gravel or broken stone in the roof construction in order to lessen the dead load. The concrete roof is laid on a false roof as a form to such thickness as the load and span require. The concrete roof may be made water-proof by the application of any of the approved roof coverings now in common use. Aside from the materials and their proper proportions, the most important factor in the construction of a concrete building are the forms. The forms are an item of great expense in the fabrication of good concrete work and their improper construction is one of the chief causes of poor work. That there may be no unsightly bulges in the finished face and to insure a plumb wall true to line, the studding for the forms should be of such number and size as to prevent vertical or horizontal bulges. The shores should be of such size and so placed as to keep the forms plumb and true to line. The lagging must be of sufficient thickness to prevent bulges between the studding.

Of the imperfections in the face of a finished wall, the impressions made by the grain of the wood, and the joint marks made by the lagging are the most common. To guard against these, it is necessary to select only smoothly dressed lumber for the lagging, and to dress up with a plane any slight unevenness where the boards butt. The liberal use of hard soap or parafin to fill the cracks and the entire surface coated with soft soap to prevent the concrete from sticking to the forms will usually give a good smooth surface. To insure a face as near free of imperfections as possible, the form should be removed after concrete has had about 24 hours' set and the entire surface rubbed with blocks or floats to work out any marks or joints.

The proper construction of forms is a subject on which your committee were unable to secure much information from the members and hope that it will be taken up thoroughly in the discussion of this report.

The face of the concrete wall may be made of such design or form as may be desired by the proper application of moldings to the forms. Ornamental work for lintels, cornices, etc., may be constructed in the forms, or molded beforehand, and set in their proper position during the construction of the work. The materials for good concrete work in building construction should be Portland cement, sand and broken stone or gravel in the proportions of one, two and four, or one, three and five; mixed to a plastic mass and well tamped in the forms. That part next to the face to be well spaded to give a surface free of voids. The reinforcements used in concrete work are of numerous makes and designs and your committee does not consider it incumbent on them to discuss the various makes and designs in this report.

As to the cost of the various designs of concrete buildings, your committee are unable to report along this line, as the information



PLAN
FIG. 19.—Oil House, C. P. R.

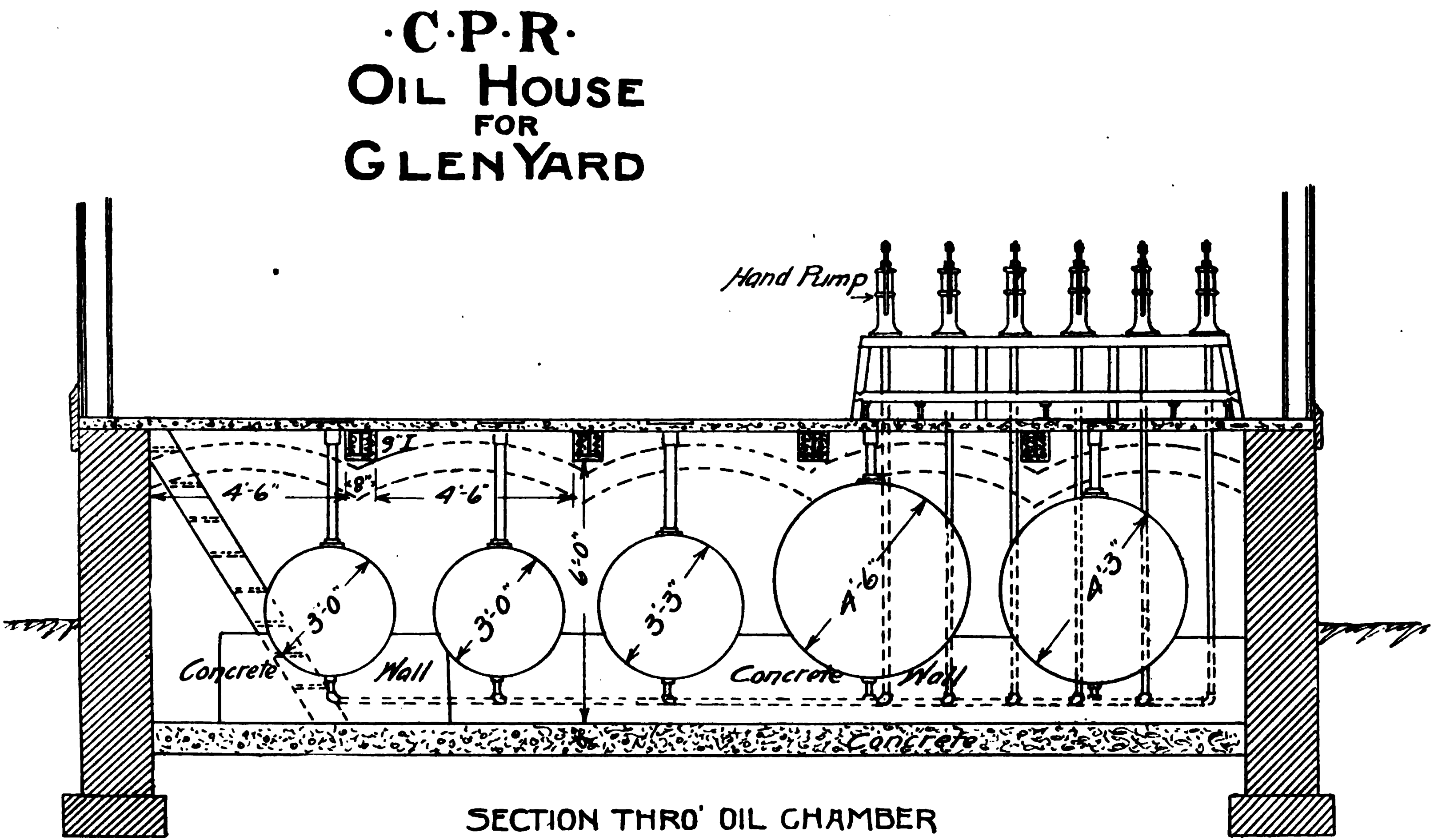


FIG. 20.—Oil House, C. P. R.

at their command would not permit of even an estimate which could be considered a basis for comparison.

As examples of concrete construction for small buildings, we present Figs. 18 to 20, plans of an oil house as furnished by Mr. F. P. Gutelius, Engineer M. of W., Canadian Pacific R. R. An inspection of these two plans shows that the concrete construction is only carried out in the floor. The building is 19 feet, six inches, by 28 feet, 10 inches, outside, and consists of a stone foundation supporting a frame building with a flat pitch gravel roof. The basement floor is constructed of a nine-inch slab of concrete with concrete supports for the oil tanks. The first floor construction consists of nine-inch "I" beams, spaced five feet, two inches, centers, reinforced and protected by expanded metal and concrete. The floor consists of expanded metal reinforcement, with a three-inch slab of concrete; the top surface of which has received a one-inch face of one to one sand and cement, floated to a smooth finish for a wearing surface. This building is one which might well be constructed with a concrete foundation, concrete blocks for walls and with a concrete roof, making an absolutely fire-proof building.

Figs. 21 to 27, as furnished by Mr. A. O. Cunningham, Chief Engineer, Wabash R. R., show a station building constructed of concrete blocks. This building is constructed of blocks molded in forms, made to represent the various kinds of ashlar masonry and dressed stone. It is a very good sample of what may be accomplished architecturally by the use of concrete.

Figs. 28 to 32, also furnished by Mr. Cunningham, show details of an engine house, the walls of which are monoliths constructed of reinforced concrete. Fig. 28 shows general plan of engine house, together with a typical plan of a stall and a vertical elevation through same. An inspection of this plan shows the outer circle and gable walls to be constructed of concrete with the interior posts and the posts forming inner circle to be of wooden construction. The roof and cornice are also of wood. In this house the concrete posts in the circle and gable walls are built as part of the wall, but of a greater thickness, forming pilasters on both sides.

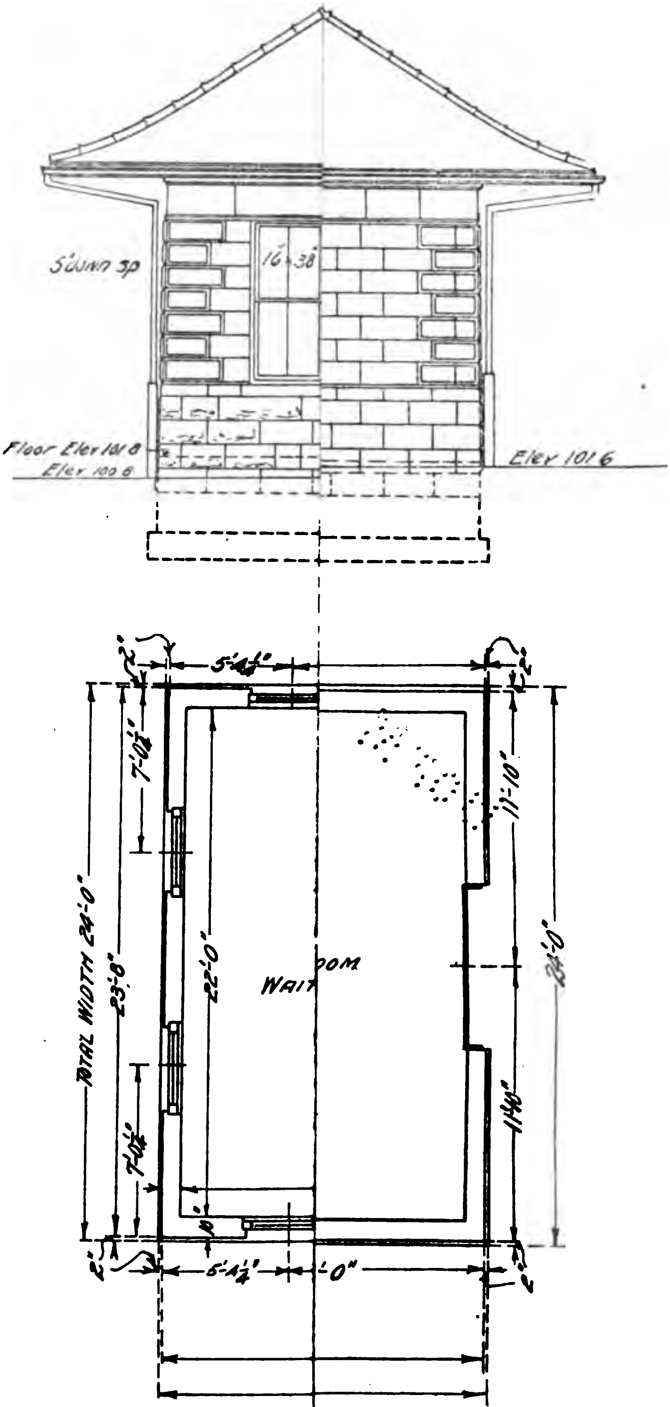
Figs. 29 and 30 show the construction of the engine pits, also built of concrete.

Figs. 31 and 32 show a very comprehensive detail of the reinforcement used in the gable and circular walls.

Mr. Gutelius of the Canadian Pacific also furnishes a print of their standard first-class engine house. On this plan labelled Fig. 33, the interior posts and roof are constructed of reinforced concrete, with brick circle and gable walls.

Fig. 34 shows a concrete engine house as built by the Grand Trunk Ry. near Toronto, Can. A description of this house was printed in the issue of *The Railway Age* of September 22, 1905, and is given herewith.

"The Grand Trunk Railroad has recently erected a new roundhouse and machine ship at Mimico, Ont., near Toronto, built according to the Kahn system of reinforced concrete. It contains 30 stalls, each 13 feet wide at the inner circle and 26 feet at the outer circle. Each stall is 82 feet long, divided into three sections and carried on four columns. The entire structure is built of concrete, reinforced with Kahn trussed bars.



OBERLY DIVISION

STATION

"The interior columns are 14 inches square and contain each four ½- by 1½-inch trussed bars. The diagonals of these steel members are bent horizontally in order to obtain the effect of hooping. Angle guards were placed in all corners in order to prevent chipping. The columns in the outer circle are T-shape, forming a pilaster on the outside and at the same time supplying recesses for keying the curtain walls between columns. The joints at these points allow for expansion and contraction.

"In designing the columns in the interior circle, it was feared that locomotives striking the outside doors would break the concrete columns which carried the doors. For this reason these columns were made of three channels filled with concrete and anchored. This construction was decided upon, as such a column would not break but would merely shift off its foundation if struck by a locomotive. The doors were fastened directly to these channels. On the side not containing a channel were placed ½- by 1½-inch trussed bars as a reinforcement.

"Radial lines of reinforced concrete girders were placed between columns at a height of about 20 feet, five inches, from top at the outer circle, and 24 feet, two inches at the inner circle. Seven longitudinal rows of reinforced concrete beams were reinforced with Kahn trussed bars in the bottom and over the supports they were invariably made continuous with inverted bars. Each beam contains in the bottom at least two bars full length and one bar about two-thirds the length at the bottom in the center and raised at the ends. Between the beams and girders is spanned a 4-inch concrete slab, which is reinforced in both directions and made continuous over the entire area.

"Special attention was paid toward obtaining an absolute monolithic character in the entire structure, so that if an excessive load were placed upon any one portion it would be distributed over the adjoining panels. Anchors for carrying steam pipes and controlling individual smokestacks over locomotives were placed in the concrete while it was green. The accompanying illustrations will show clearly the method of construction and the pleasing appearance obtained. It is stated that there has been obtained a permanent, fire-proof, attractive and economical roundhouse at less cost than steel and also with a large saving in time of erection.

"The machine shop roof is constructed similarly to that of the roundhouse, using a series of beams about 12 feet o. c., spanned with a 4-inch concrete slab. These are also reinforced with trussed bars."

The C. R. R. of N. J., at their terminal at Elizabethport, have constructed all of their shop buildings with concrete walls. The list consists of an engine house 400 feet in diameter with concrete walls and wooden roof. A forge shop, 175 by 300 feet, with steel columns supporting steel roof trusses covered with plank and gravel roof. The walls of this building are curtain walls and are but eight inches thick. The power house in connection with this plant is 22 feet wide by 175 feet long and is constructed entirely of concrete. An attempt was made by your chairman to secure plans of these buildings, but without success. An article, which may be of interest in the line of concrete buildings, appeared in the May, 1904, issue of *Carpentry and Building*, as a paper read before the Indiana Engineering Society by Mr. H. C. Briebaker

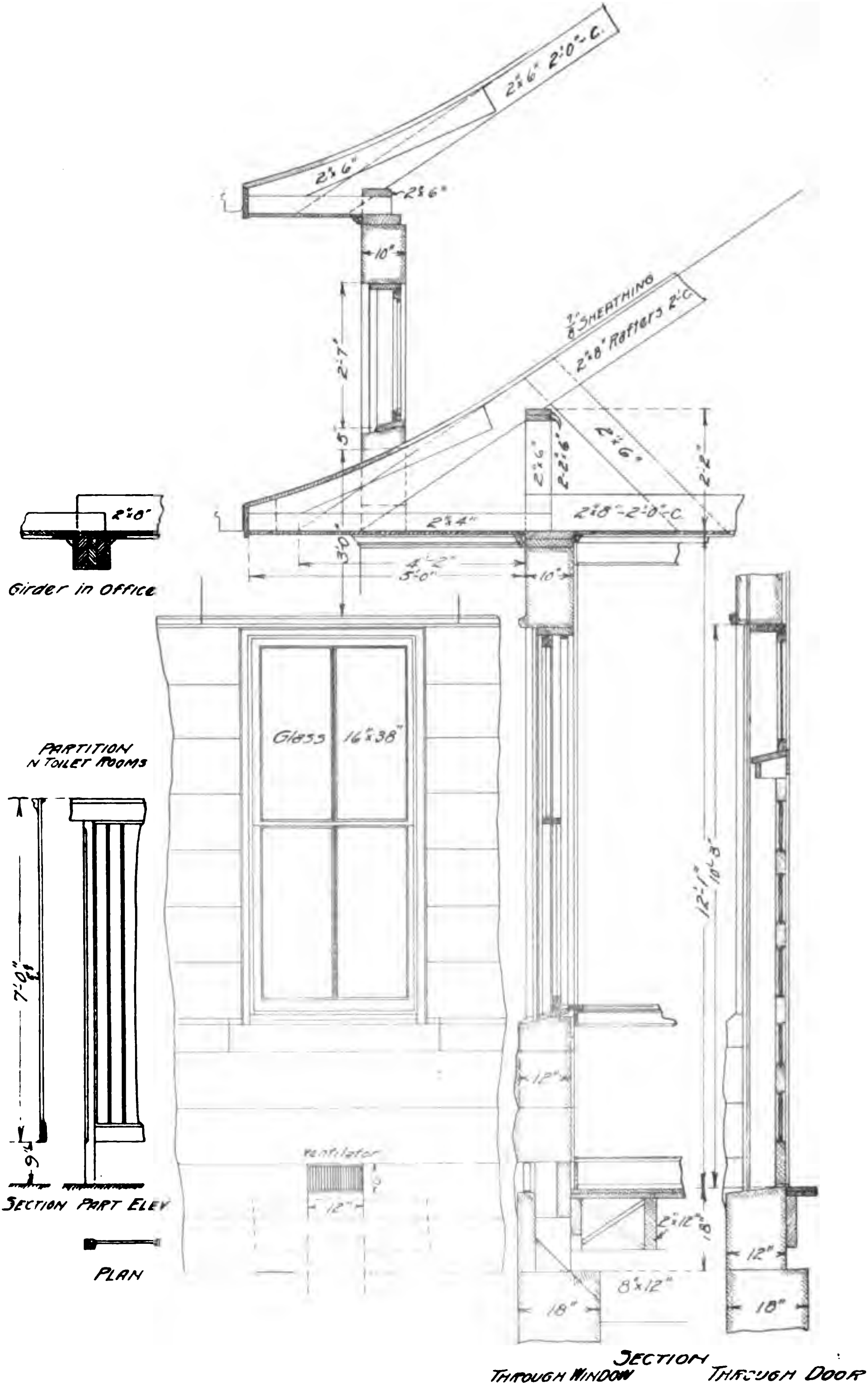


FIG. 23.—Concrete Station, Wabash R. R.

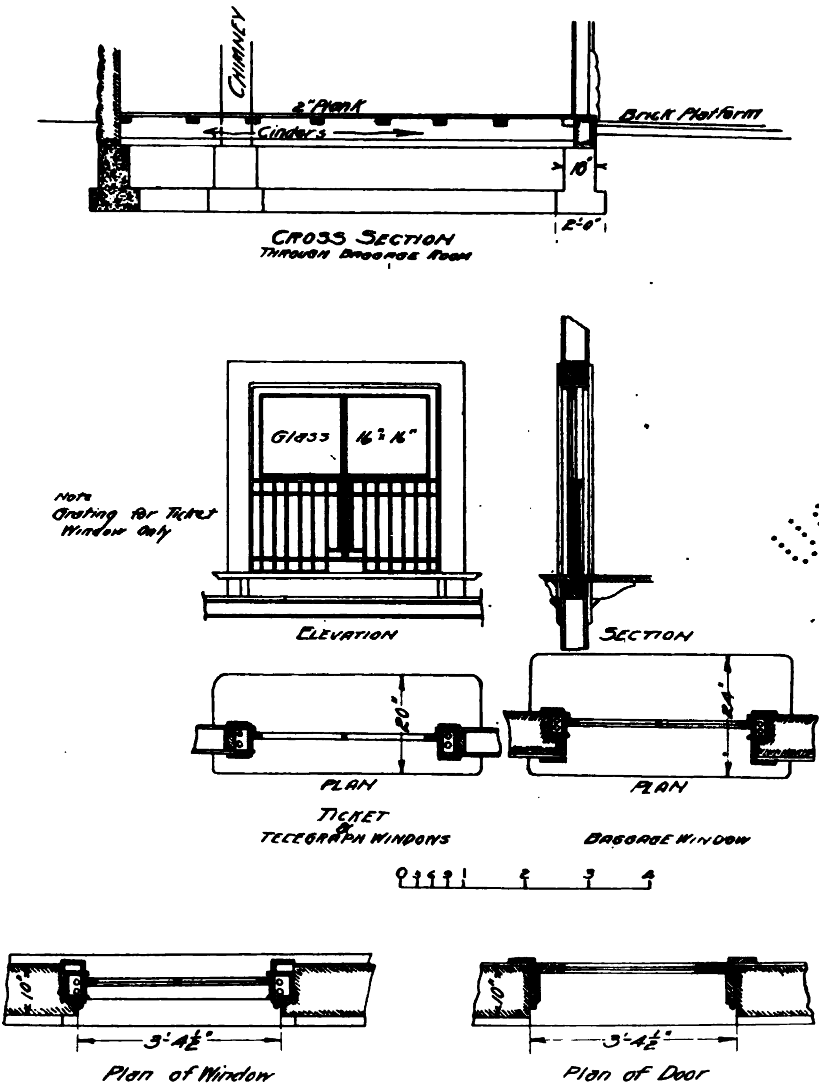


Fig. 24.—Concrete Station, Wabash R. R.

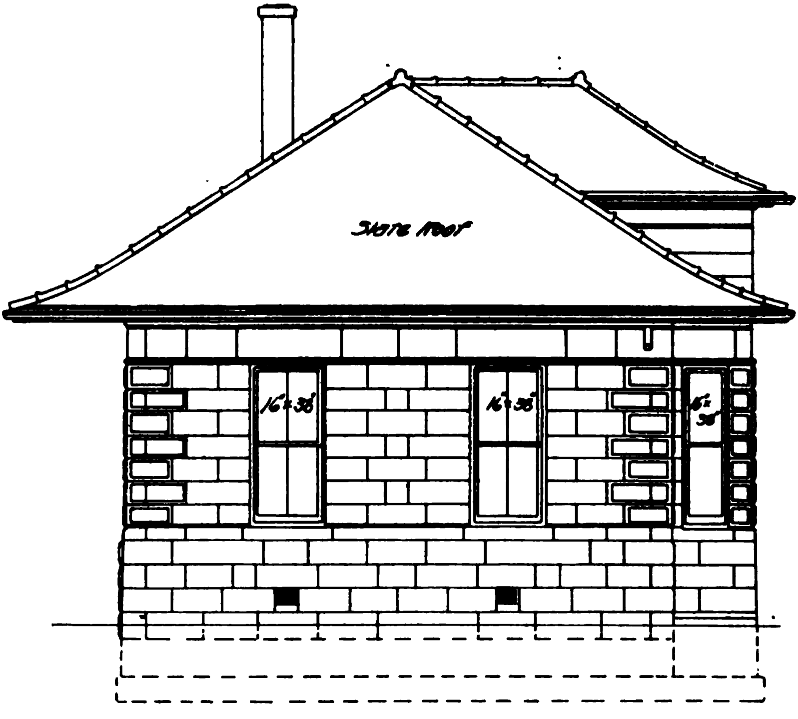


FIG. 25.—Concrete Station, Wabash R. R.

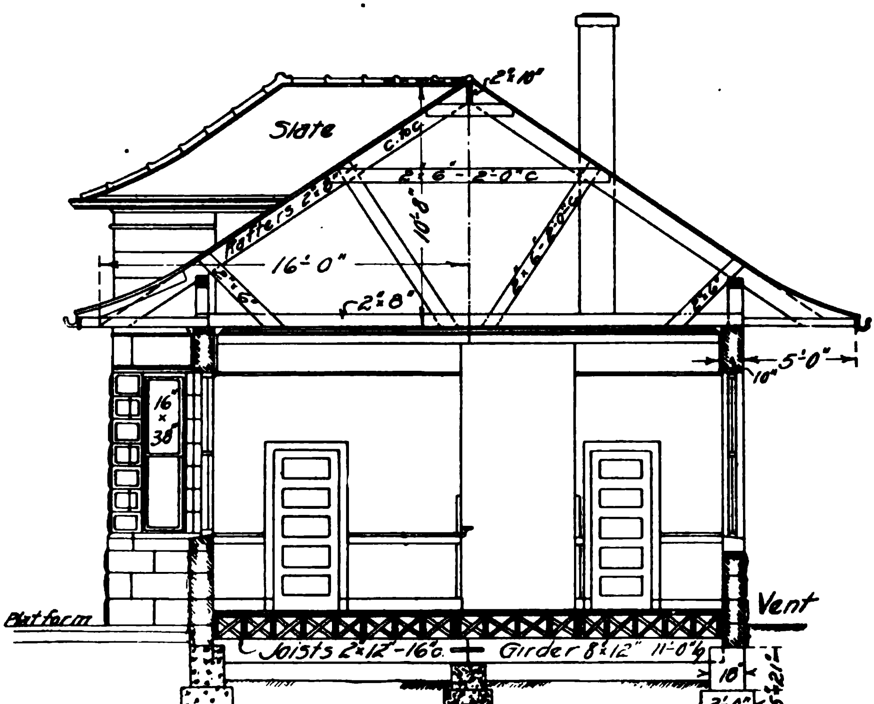


FIG. 26.—Concrete Station, Wabash R. R.

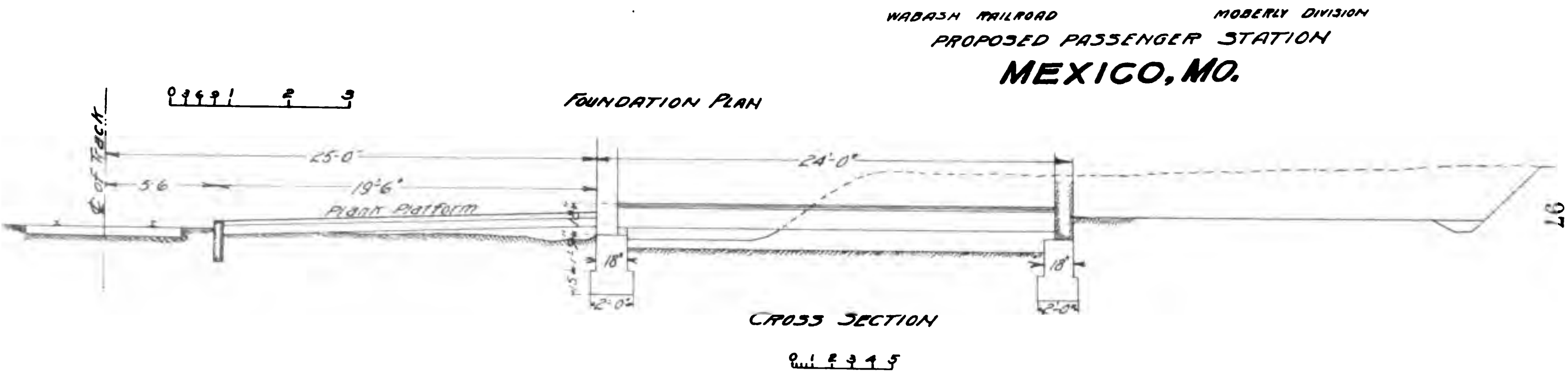


FIG. 27.—Foundation Plan, Concrete Station, Wabash R. R.

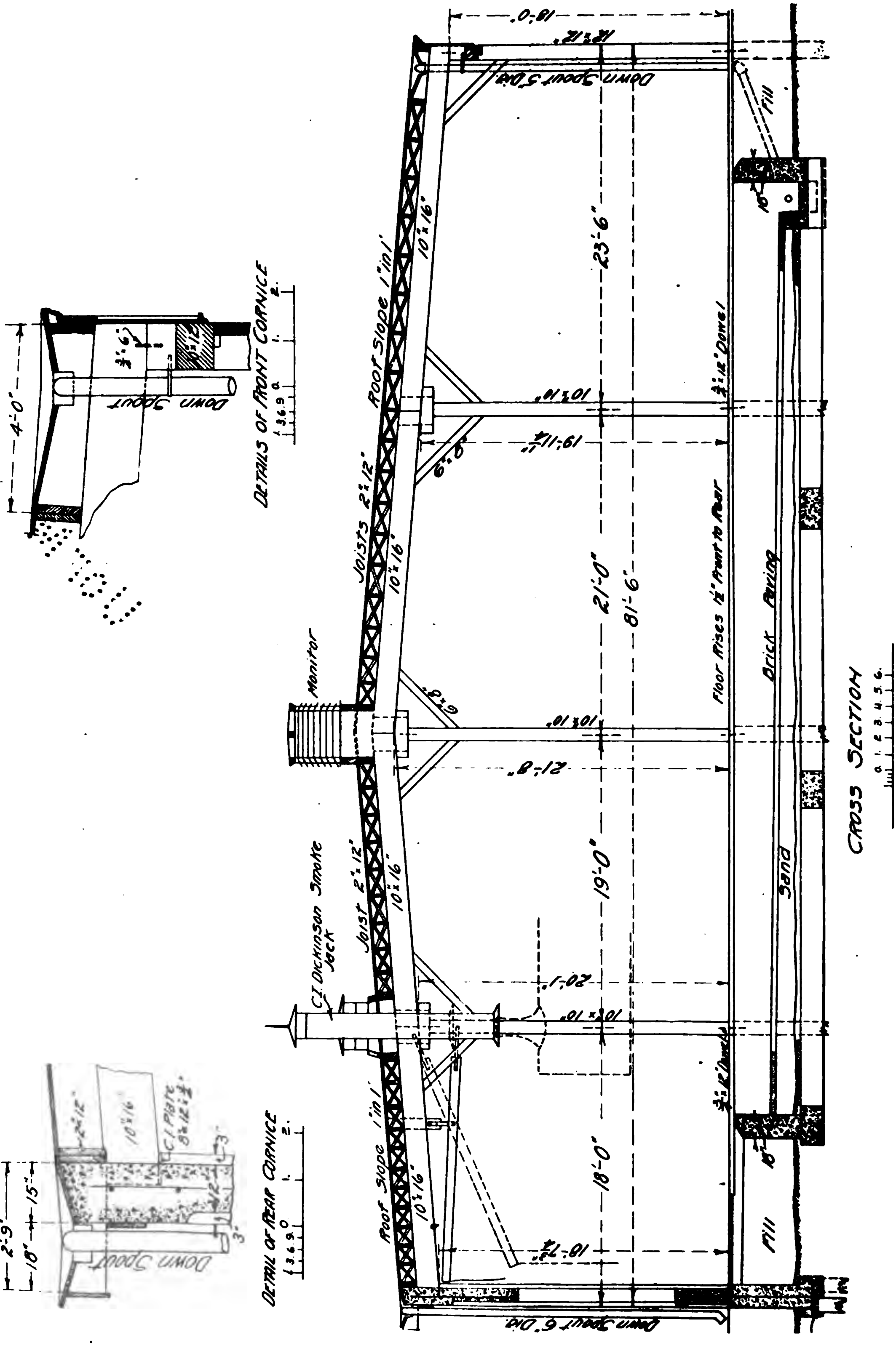
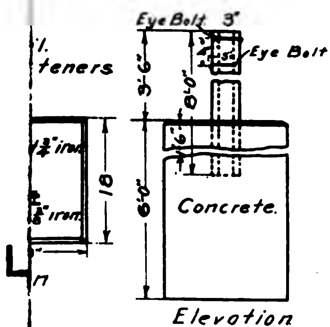


Fig. 28.—General Plan of Concrete Engine House, Wabash R. R.


Fill.
Fill.
Present Ground
Present Ground
4'-6"
18"
18" 18"
3'-0"


Eye Bolt
3"
Eye Bolt
teners
3'-6"
8'-0"
6"
18
6'-0"
Concrete.
Elevation

of Indianapolis. An extract of this article, descriptive of the Ingalls building of Cincinnati, Ohio, is herewith attached:

"This committee was instructed to investigate and report on the bold project of building a sky scraper, 16 stories high, entirely of reinforced concrete and without a structural steel member. The ambitious plans of the promoters are no less striking, now that their plans have been carried out with success.

"A monolithic mass, 100 by 50 feet in plan—21 feet below grade and 210 above grade—in which the footings, columns, walls, girders, beams and floors are all one and the same, differing only in shape and position, and continuous, without a joint or break, from the foundation to the cornice, and built of particles, so to speak, all of which could pass through a one-inch screen, with no member larger than three and a half inches in diameter, is a marvel which rivals the pyramids.

"The system used throughout the building is the Ransome system, which consists of twisted bars embedded in concrete. The columns are from 12 by 12 to 34 by 38 inches, and carry as high as 750 tons at the footings. The column stools are built of cast iron embedded in concrete and are particularly interesting in design. The sizes of the columns were limited by the architectural design and the deficiency in strength was made up by the iron bars, there being from four to eight 3½-inch bars to each column, bound together by hoops of wire, each 12 inches in height. The girders have as large spans as 33 feet and are from 27 to 36 inches deep, including thickness of floor, which is from five to seven inches. The columns are spaced 16 and 33 feet. Intermediate beams make the floor panels 16 by 16 feet.

"The loads on the floors were figured at 60 to 80 pounds per square foot for the upper floors, and 300 pounds for the first floor. The exterior walls between piers are eight inches thick and some walls next to adjoining buildings are as little as three inches thick. Of course, these walls carry no loads.

"The first to third stories are veneered with marble, which is supported by projections from the concrete fitting into grooves in the marble. The upper stories are veneered with brick, which is supported at each story height by a ledge of concrete.

"The general features are strikingly similar to steel cage construction; in fact, the design is the same, and the loads, strains and stresses are figured in the same manner.

"It is hardly our province to predict the weathering of this structure. Time only will prove its durability. But the large amount of money was expended and the enormous responsibility was assumed by men who evidently were thoroughly convinced of the success of their undertaking."

In concluding this report, we desire to bring to your notice plans and photographs of a concrete machine shop erected at McKees Rocks by Mr. R. A. Cummings of Pittsburg, Consulting Engineer and proprietor of the Cummings system of reinforced concrete. The building in question consists of a main building, 51 feet, seven inches, by 160 feet long, and is 40 feet to the square with a lean-to full length of building on each side, one being 18 feet, 9 inches wide, and the other 31 feet. The main building columns, spaced 20 feet centers longitudinally, are of concrete, circular section 20 inches diameter. These columns also support

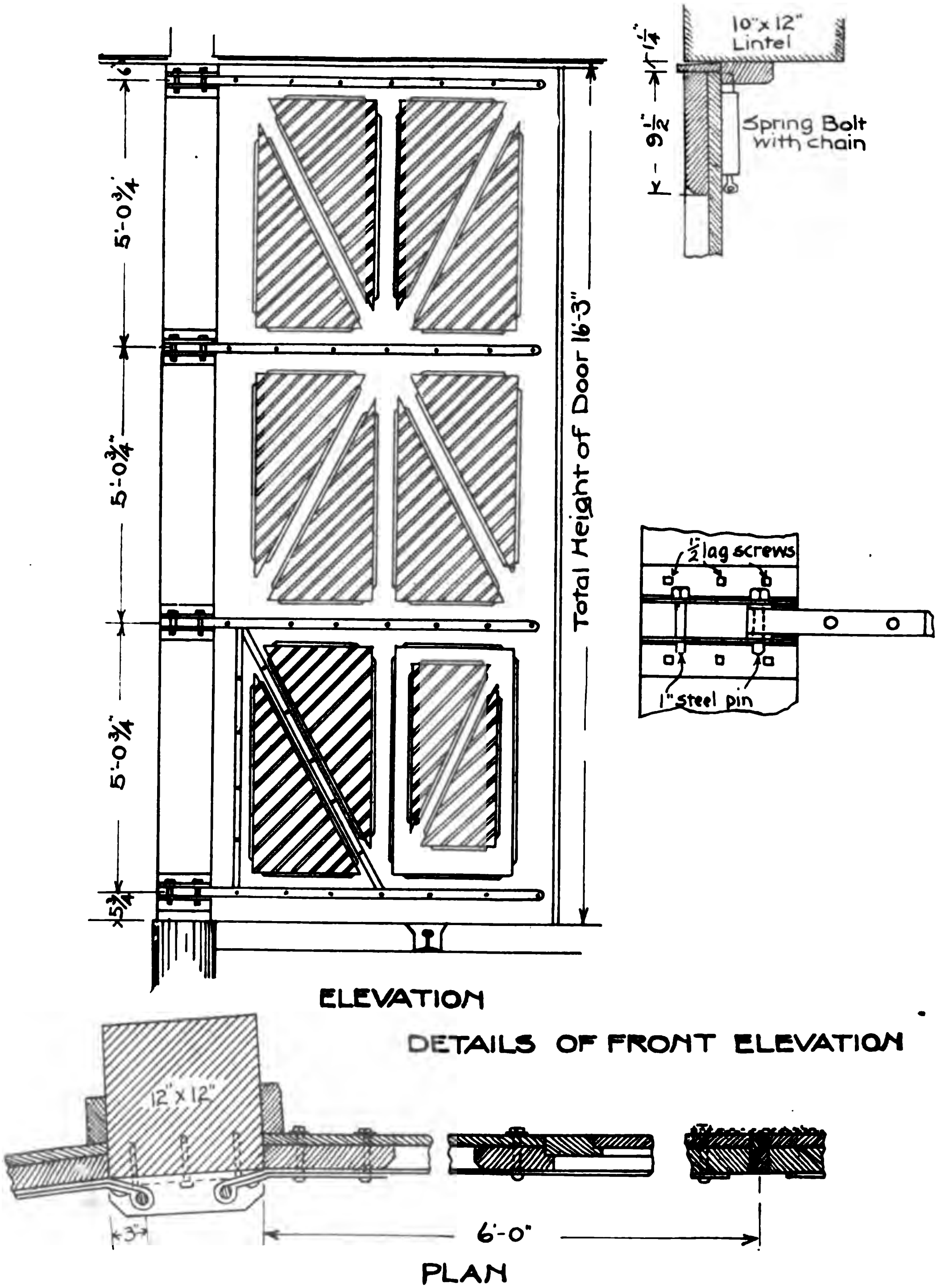
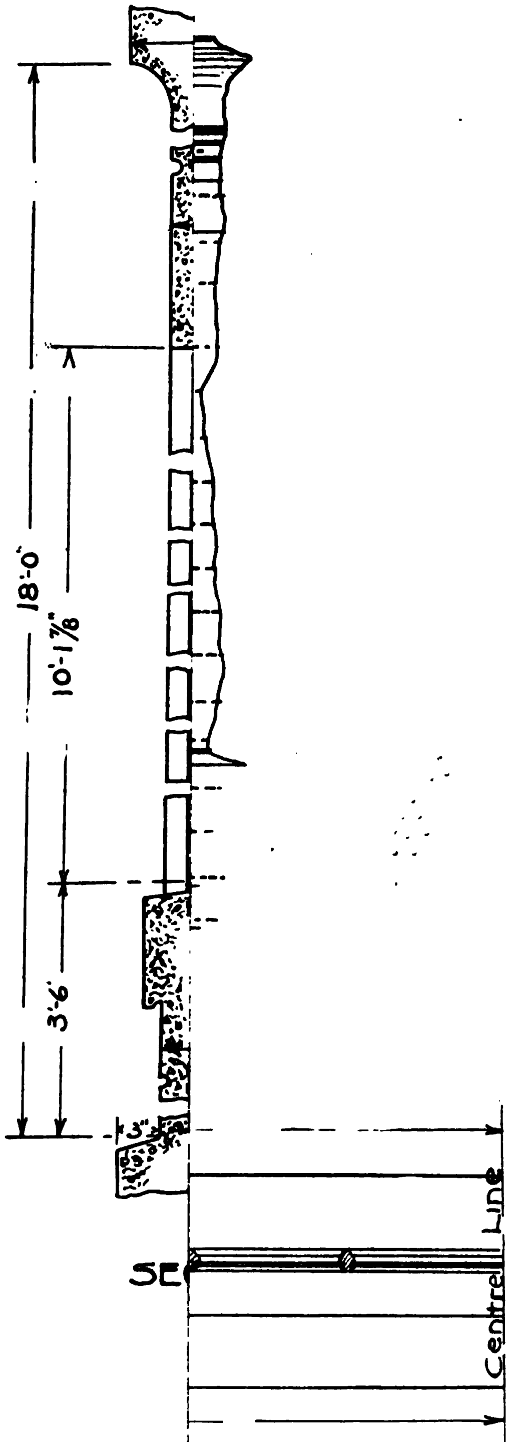
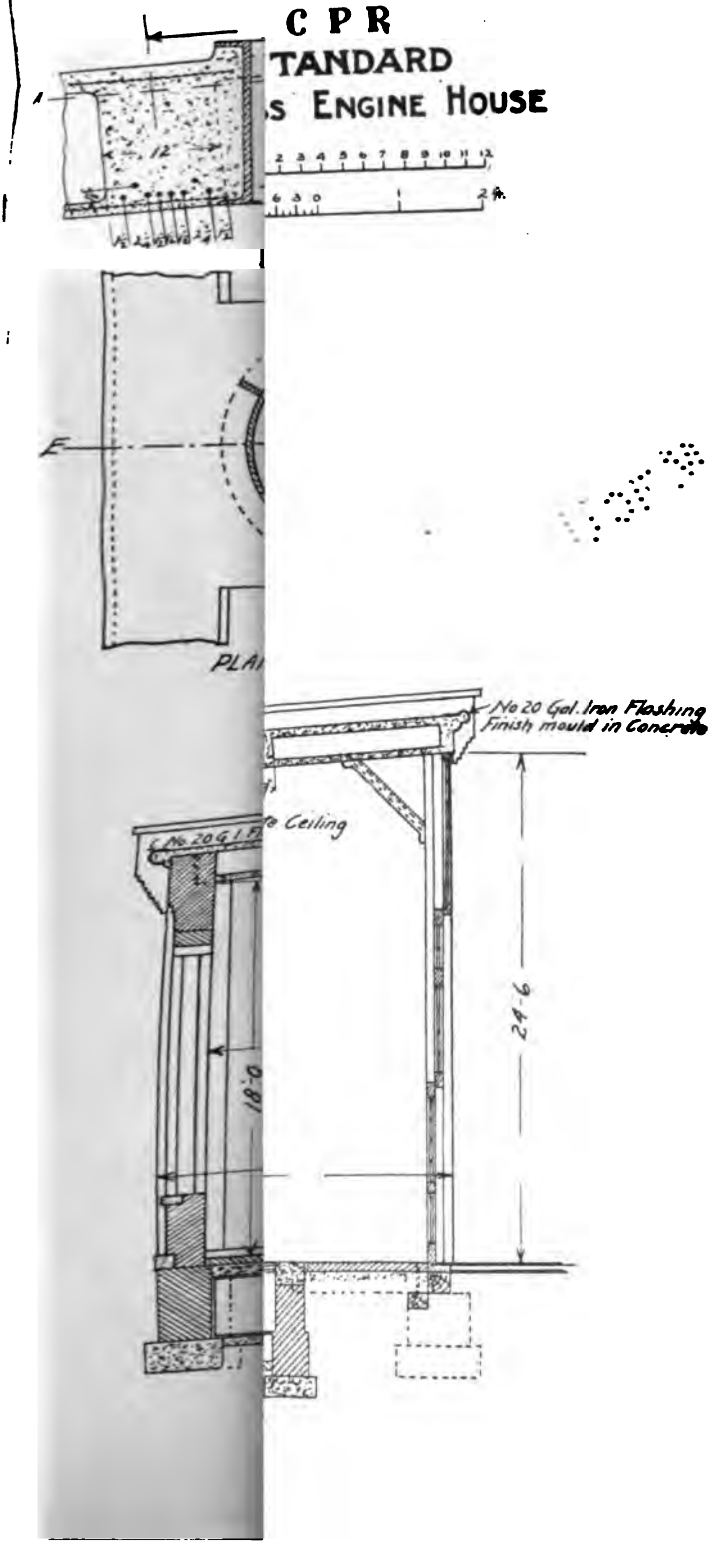
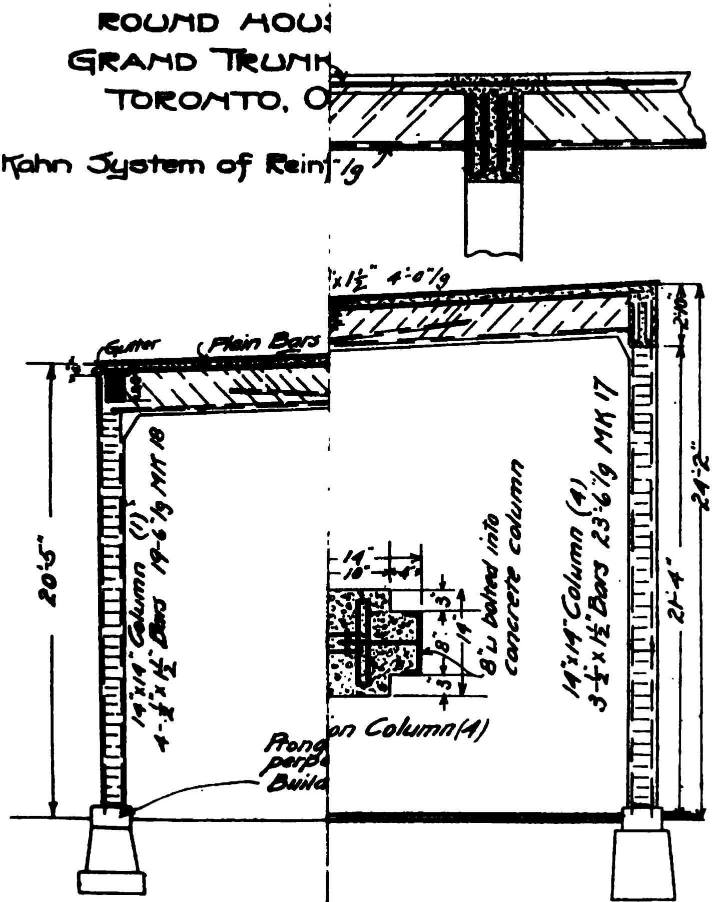


FIG. 81.—Details of Engine House, Wabash R. R.



PLAN


C P R
TANDARD
S ENGINE HOUSE
12
PLA
No 20 Gal. Iron Flashing
Finish mould in Concrete
Ceiling
No 20 G.I. F
18'-0
24-6


ROUND HOUS
GRAND TRUNK
TORONTO, O
Kahn System of Rein
Gutter
Plain Bars
20'-5"
14"x14" Column (1)
4-½"x1½" Bars 19'-6"/g MK 18
Prong
perpe
Build
14"
10"
3"
8"
8" L bolted into concrete column
on Column(4)
14"x14" Column (4)
3-½"x1½" Bars 23'-6"/g MK 17
2'-10"
24'-2"
21'-4"

the runways for a 30-ton capacity traveling crane. The columns for the lean-to are rectangular in section, 12 inches square, and support concrete girders running to main building columns. These girders carry the four-inch slab of concrete forming the roof of the lean-to. A concrete strut is provided between the crane runway columns at a point about midway between the floor and the crane runway. The columns are corbelled out at the runway girders and the struts thus form capitals.

The crane runways are provided with bolts set in the concrete to secure clips for the tee-rail for traveling crane. The roof is carried on 12 by 12 inches rectangular columns, which are in turn carried on the girders supporting roof of the lean-to.

In the roof of the main building we find a concrete construction which is original and unique and a radical departure from anything before attempted in the reinforced concrete line. The roof is supported on concrete roof trusses of segmental design, spaced 20 feet centers. The top chord of this truss is formed of a concrete rib eight inches wide by 10 inches in depth, reinforced by three-quarters-inch bars. The bottom chord is formed of six by six inches concrete, reinforced by two three by two and a half by seven-sixteenths inches angles. The roof covering consists of a reinforced monolithic slab of concrete four inches thick at the crown and increasing to 10 inches in thickness at the haunch. The forms used for the construction of the circular columns were built of galvanized iron and are in themselves an original design.

It may be of interest to note that this building was constructed entirely during winter weather; steam heat being used in mixing the concrete and in keeping it from freezing until its initial set. This building was erected a year ago and up to date does not show a crack or sign of failure. It was built in competition with a structural steel building of the same size, and was constructed, I am informed by Mr. Cummings, at a price about one-quarter of a cent per cubical foot of contents cheaper than the building of structural steel.

Mr. Cummings has kindly furnished me with two photographs and with blue-print plans, showing elevations, sections, detail of arrangement at the haunch of roof arch and a detail of the form for circular column, all of which are herewith attached.

In conclusion, we wish to thank the members who assisted in this report by their prompt replies to the list of questions sent them.

C. W. Richey, *Chairman*,
A. O. Cunningham,
C. F. Loweth,
G. A. Wright,
F. P. Gutelius.

SUPPLEMENTARY REPORT.

Wanganui, N. Z., September 11, 1905.

I note that concrete building construction, including platforms, is one of the subjects for report at the Convention. As I presume passenger stations are referred to, I would like to mention a method of making concrete platform fronts, adopted on some of our lines with good results. The usual height is 18 inches above

FIG. 35.—Concrete Machine Shop, McKees Rocks, Pa.

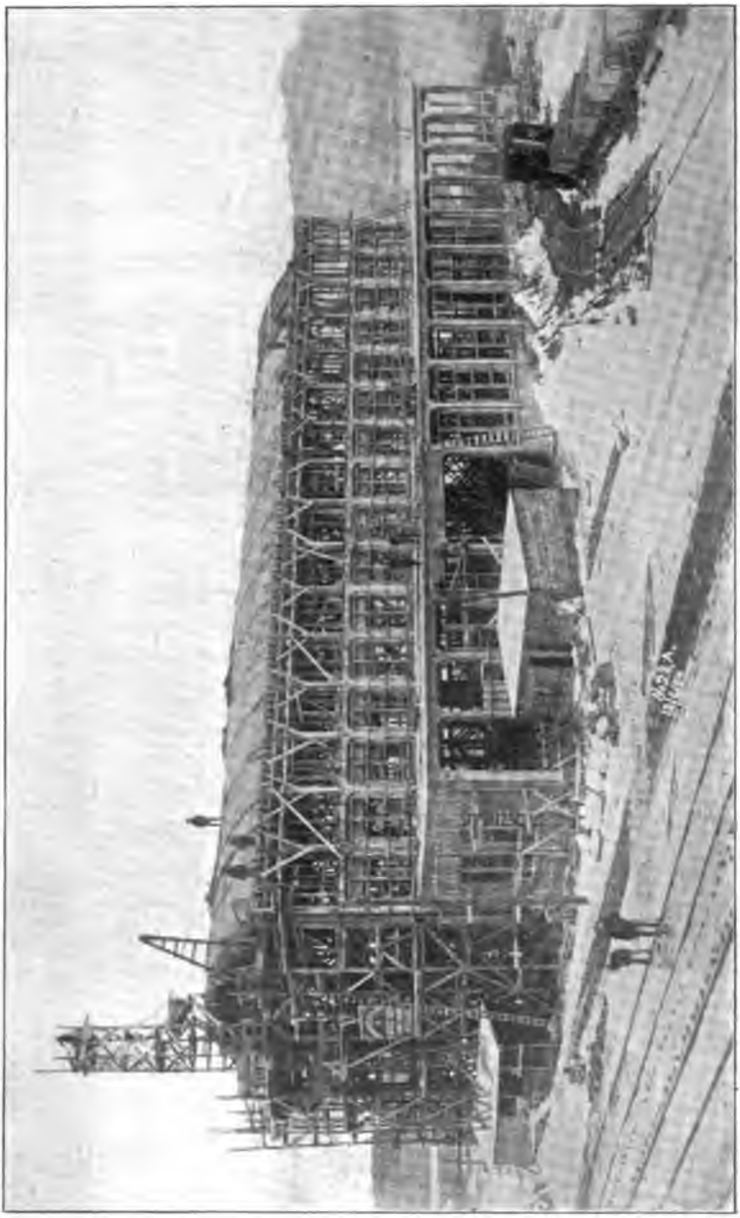


FIG. 36.—Concrete Machine Shop, McKees Rocks' Pa.

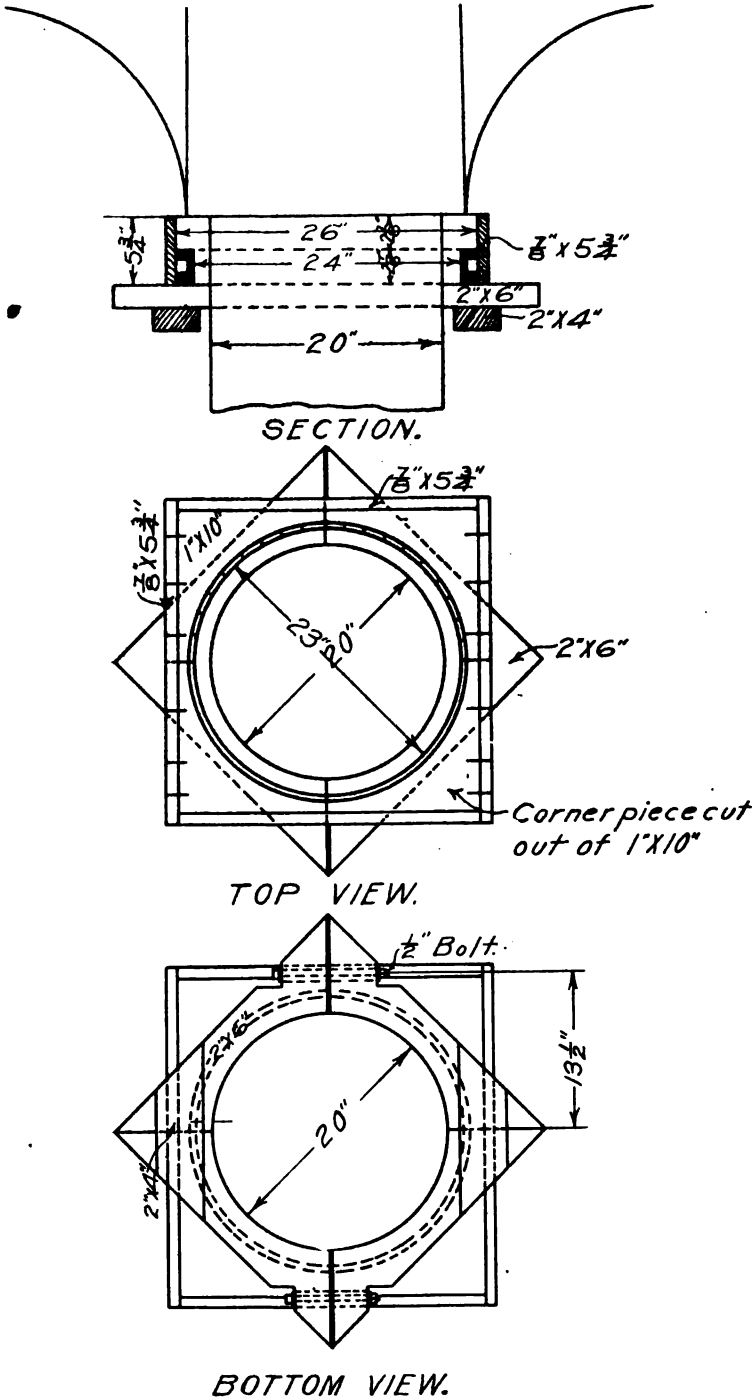


FIG. 37.—Details of Machine Shop, McKees Rocks, Pa.

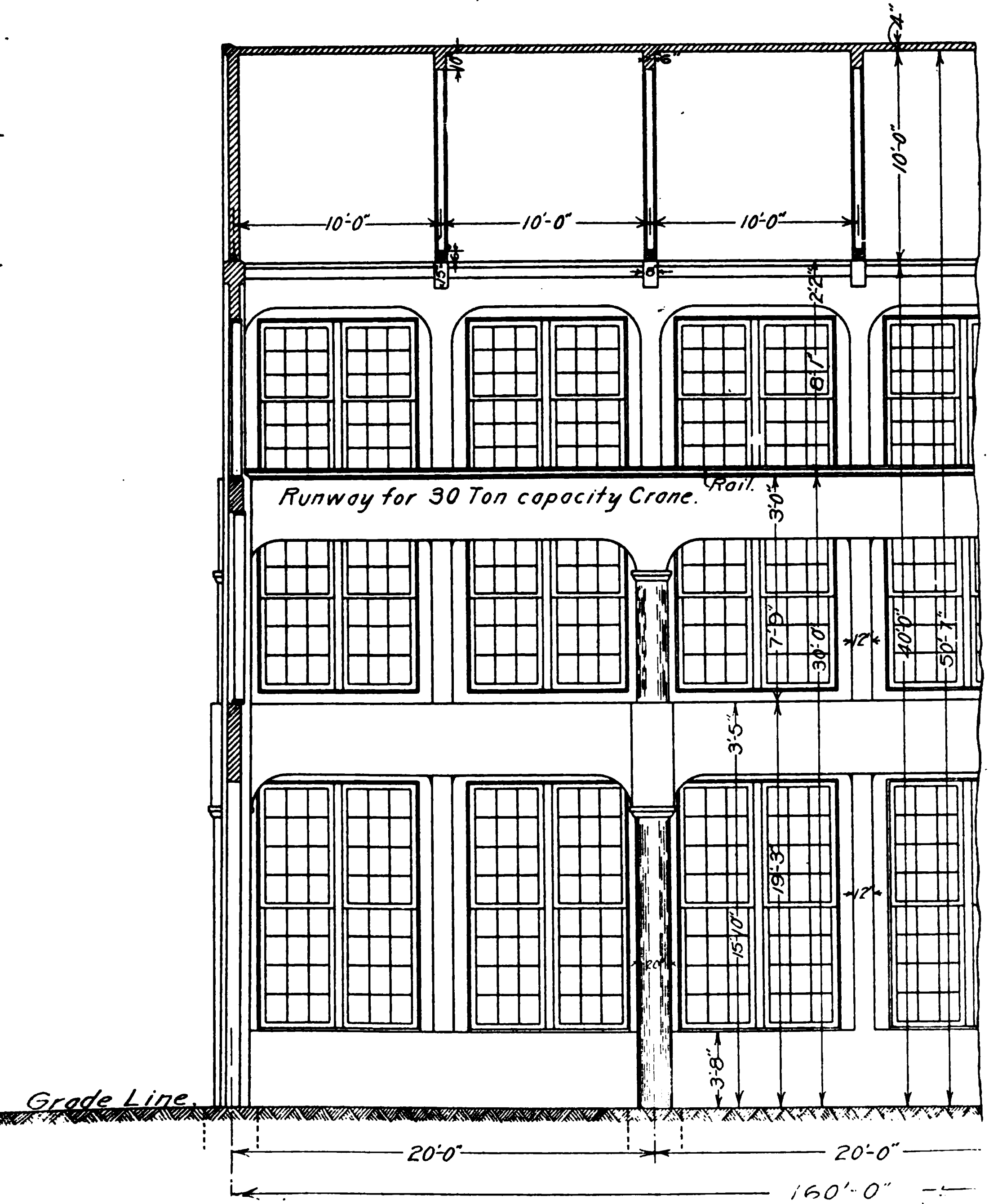
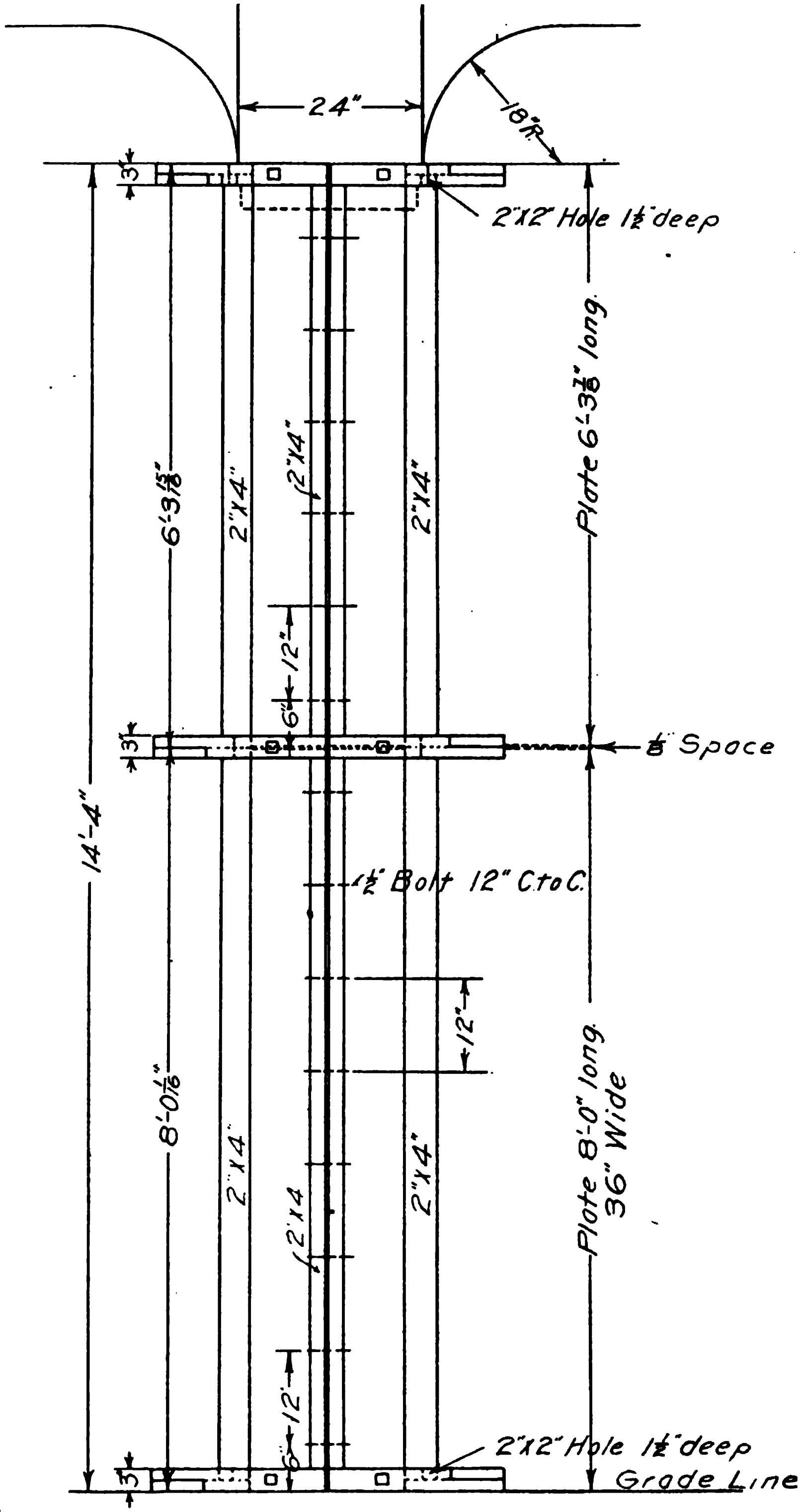


FIG. 88.—Details of Machine Shop, McKees Rocks, Pa.



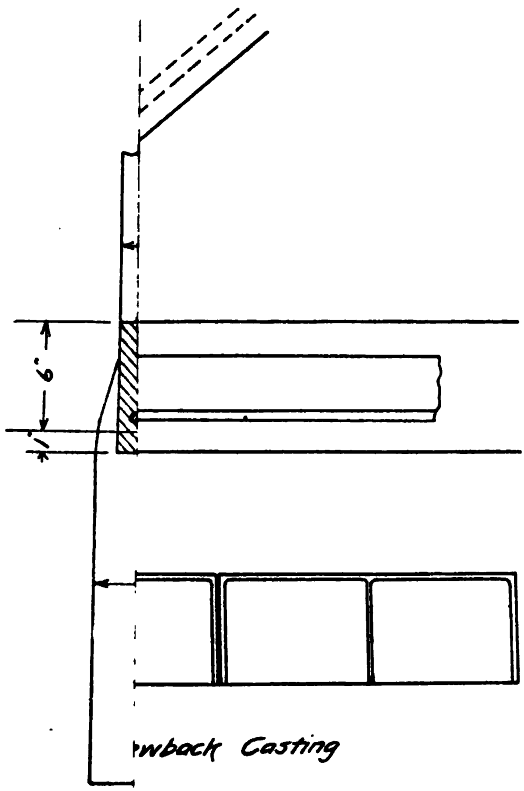
DETAIL OF FORM FOR 20" CIRCULAR COLUMN.

FIG. 39.—Machine Shop, McKees Rocks, Pa.

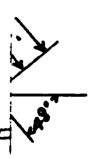
TAYLOR & WILSON

McKEES ROCKS

Cumming's System of F

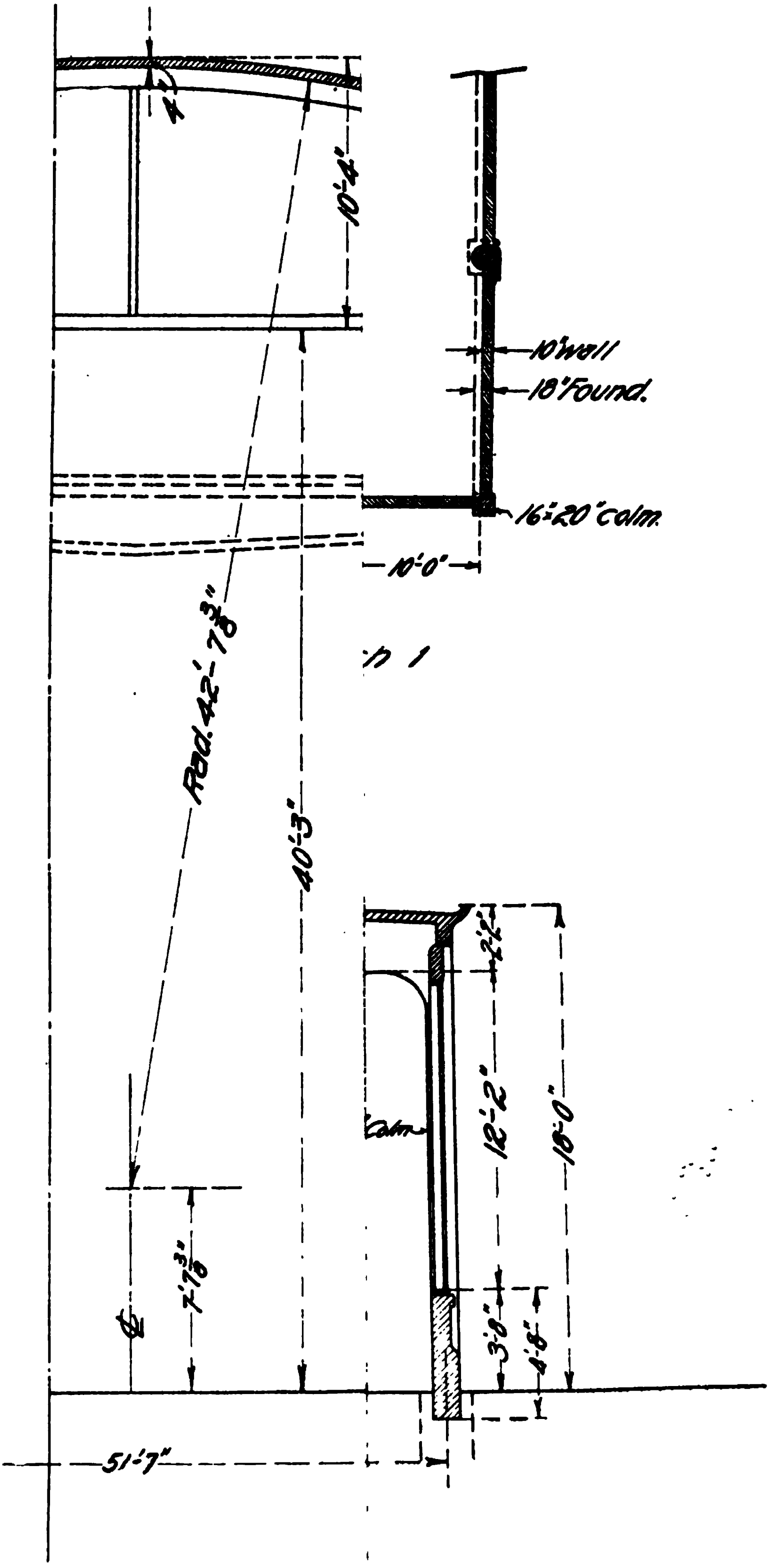


wback Casting



Detail of F

Casting



4"
10'-4"
10"wall
18"Found.
16"x20"colm.
10'-0"
Rad. 42'-7 3/8"
40'-3"
2'-2"
12'-2"
18'-0"
colm
7'-7 3/8"
3'-8"
4'-8"
51'-7"

the rail and two courses of concrete blocks are used with a rebated longitudinal joint. The blocks are first molded two feet long. The lower, or foundation, course is made of the cheapest available class of concrete, but the upper course of blocks are of cement and stone chips, carefully molded so as to secure a close and hard wearing surface.

As compared with constructing platform fronts of concrete in Situ the advantages of building with previously molded blocks are as follows: It is unnecessary to throw the track to make room for forms. Work interfering with traffic is limited as much as possible and should future alterations involve shifting such a platform, the facing (or curb) is not destroyed, but can be used again. The cost is found to compare favorably with a continuous wall built in forms on the spot.

C. Holm Biss,
Engr. Government Railways.

DISCUSSION.

Mr. Richey.—I regret that I did not get the report out in time to have it printed in regular form and distributed to all the members before the Convention. However, I will furnish Mr. Cummin with a carbon copy of the report now in my possession, if he wishes it.

President.—Gentlemen, the subject is open for discussion.

Mr. Steffens.—This matter of re-enforced concrete engine house construction is an important one and ought to be viewed more from the maintenance standpoint than it is. Every member who has had any dealings with roundhouse work has at some time received a call from the motive power department stating that an engine had inadvertently punched through the wall and asking to have immediate repairs made. In case of a concrete house, thoroughly re-enforced with steel rods, the necessity arises for cutting apart the tangled rods and splicing them in the new work. This point will largely appeal to the members as one in favor of a construction involving the use of brick or wood, or some material, in other words, capable of repairs. On our system a complete engine house was designed of re-enforced concrete, but fortunately was not built. A brick house is being erected instead.

A concrete walk, even at best, is bound to be a slippery

walk in frosty weather. There are walks in New York City, built of concrete, that when they are simply moist are worse than if ice coated. Members who have ever walked over the sidewalks of the subway stations have undoubtedly observed this.

The experience with brick is limited on the particular road with which I am associated. I noticed with considerable pleasure that the Lake Shore is almost entirely devoted to the use of brick platforms. At Ashtabula a platform that has been in place for several years seems to be in remarkably good condition.

Mr. Richey.—Mr. Steffens' statement regarding slippery platforms is correct for some platforms. If the surface has been over-troweled or dusted with cement before troweling, it will then be glassy and very slippery. Troweled surfaces not roughened by a dotting roller are also slippery. If, however, the surface is finished with a float or is artificially roughened, slipperiness would be the last criticism you would make.

Mr. Hudson.—You can make concrete rougher than a brick platform by floating down the concrete with a rough-edged board and that will make a surface that wears better than a troweled surface.

President.—I might make a remark on cement platforms and walks. On the Northwestern we have been building for a few years past a number of cinder concrete platforms, using for the body cinders, sand and cement, in proportions three, two and one, making a rough surface and not troweling it. A cinder concrete platform will not wear smooth. I have in mind a platform at Fond du Lac, Wis., that has been built four years and I have never seen it slippery but once, and then on account of a heavy sleet.

Mr. Perry.—We have put down quite a good deal of concrete platform and we have one that was put down about six years ago. This platform was laid in sections and we cut it through in blocks, about five feet by six feet square, by laying blocks alternately, so that the action of the frost

would not break up the sections. We first put down about ten inches of cinders and then four to six inches of concrete and cement on top. That platform has been in steady use ever since and we have never had any trouble with the same.

Mr. Cummin.—I hoped this would be one of the subjects to be carried over to next year, especially on account of buildings more than the platforms. I think the most of us know what a concrete platform is and understand pretty well the construction of it, but in the building line, that is something that has come up in recent years, and I, for one, believe is going to come, in time, into universal use. Now at our next meeting, if I am spared to be with you, I hope to be able to give you a description of a concrete building that will probably surprise you. We are building concrete stations on elevated roads and we are building concrete platforms on elevated roads. The platforms have just been finished within the last month. We have two buildings that are in course of construction now, and we hope to be able to use them in about a month. When the subject of building concrete platforms came up it was looked down on by a number, on account of the vibration which naturally takes place on an elevated system, but so far those platforms are holding up first class. We have one little station on one of the elevated structures that has been finished over a year and there is not a sign of a crack in it. Trains go by within two feet of this station at a rate of 45 miles an hours on an elevated track. Now if this subject is carried over another year I can have plans and specifications and full information in regard to how they stand up. I do n't know of another case anywhere where there are concrete buildings constructed on an elevated system.

Mr. Richey.—I sent a circular to Mr. Cummin and he answered fully on platforms, but he did n't say a word on concrete buildings, and I was rather disappointed that he did not answer along that line. Had Mr. Cummin been pleased to report on them I would have been glad to have

included the concrete station buildings on the Long Island road in my report.

Mr. Cummin.—Mr. President, I would not like to have written to him that we had concrete buildings on an elevated structure that were a perfect success, and then next year have to acknowledge they were a failure. I would rather wait until next year before reporting on them.

Mr. Pickering.—I would suggest that the Committee on Selection of Subjects be requested to continue that subject with the present chairman and recommend to the president that Mr. Cummin be put on that committee with him.

President.—That's right. (Applause.)

President.—Anything further, gentlemen, on subject number three?

Mr. Clark.—Now in carrying this subject over to another year, would it not be well to include bridges, such as arches and foundations, in connection with this committee? This is something I am considerably interested in. We do not use very much concrete in sidewalks and we are not going into concrete buildings, but we are working concrete in bridges to a great extent, so I will be very much interested in it.

President.—We will make this known to the Committee on Subjects.

Mr. Clark.—It is something we should keep in touch with, as there is nothing in railroad work at the present time making the advances that concrete is. There is a vast difference in the use of concrete now and three to five years ago, and the report of the committee that length of time ago would not be up to the standard of the present time. I just last week finished one set of abutments for a bridge of four tracks and I expect to do more of it and I think it is a subject that we ought to keep in touch with.

Mr. Reid.—I think the subject of concrete warrants a standing committee on concrete being appointed and that can be sub-divided on bridges and buildings, if necessary. We have several concrete buildings in Cleveland. The Sal-

vation Army have a concrete building all the way through, floors, walls and everything. There is also a German theatre in Cleveland, partly of concrete, and some other buildings.

Mr. Cummin.—I would suggest that the president ask some of the new members if they have n't something to offer on this subject. I do n't think it is right for a few of us to take up the entire time of this Association. Probably there are a number of men sitting round here that could give us all points. Otherwise, the proceedings, when printed, will show that Richey, Steffens and Cummin, with a few others, took up the whole time.

Mr. Richey.—I would be glad to hear from some of the members a description of their method of constructing forms for the different kinds of concrete structures.

Mr. Steffens.—Would not that come within the scope of a new subject, "Handling Concrete"? The subject is large enough to be divided and can be placed well under a paragraph relative to handling the work. As undoubtedly we are all aware, the American Society of Civil Engineers are now investigating the subject of re-enforced concrete and any investigation made by our members should not be along the line of designing, but should confine itself to the practical, or maintenance, side entirely. As I understand the object of our Association, we are not designers (although a number of us can design).

Mr. Killam.—This concrete matter is something that has taken my attention for some time, although I do not directly work with it, but I notice what is being done. Now as to the question of whether a house can be built or a suitable building constructed of concrete, to my mind that depends entirely on the foundation used. A concrete building will crack just the same as a brick building if the foundation is not sufficient, but you have the foundation of the building sufficient and a concrete building, to my mind, as has been proven, is just as good as any other building, if not better. If you have a sufficiently good foundation, such as is neces-

sary for the well-being of any structure, concrete is as good, if not better than any other structure you can put up. Also, in regard to platforms, we have a platform at Levis. This platform was built about four years ago, on muddy bottom, where the St. Lawrence River was filled in with broken rock, etc., and then coal cinders put on and ballast on top. We allowed it to settle a year and then laid concrete on top of that, four inches thick, and there is not a crack in it thus far. This platform is 700 feet long and 35 feet wide. Then we have others at Halifax, etc., and in no place have the platforms given out. As to slippery platforms, we have never experienced much trouble in that respect, but you have to keep pretty straight.

Mr. Heflin.—Mr. President, we are all more or less interested in the subject of concrete. I had a little experience which I will mention, which might be of interest to think about. I had occasion to take down a concrete wall which had been built about seven years. In taking it down, we found by using steel wedges we could take it off in squares from eight to twelve inches thick and from six to eight feet long. This fact indicated that the layers, being put one on top of the other after the first one had partially set, had not properly united and left spaces or interstices, through which the water could percolate, evidently injurious to the wall. I would like to know the best remedy to overcome this—to prevent the water from seeping through and defacing the face of the wall and to make the wall solid and not in slabs or blocks, as appeared in this case.

Mr. Rettinghouse.—At the risk of appearing too often in print, I want to say, or refer back to the statement made by our worthy friend from Canada, that his platforms never get slippery. I can understand that very readily, because I had a letter from Mr. Killam once, stating they had 12 feet of snow. I also understand they never clean any of their platforms. How could they get slippery? (Laughter.)

Mr. Killam.—Produce the letter.

Mr. Rettinghouse.—In regard to the question made by a former speaker in regard to seams appearing in concrete walls, I presume that is due to incontinuous operation. If the concrete were placed with a continuous working force, day and night, there would not be any seams. I notice, when working with the day force only, where they knock off at night, after the work is completed one can see a seam.

President.—Any of the new members anything to say on this subject?

Mr. Penwell.—We have been using concrete for foundations for buildings and bridges for the last four or five years, but when you want to remove it, it is a fierce proposition. Now the question brought up about roundhouses. If we were building any roundhouses I would like to see them built of re-enforced concrete, but it is a fact and you cannot get around it, that as long as the mechanical department is going to knock our walls down that that concrete wall must be provided with a bumper, or re-enforced with some sort of a pilaster that will ensure the perfect safety of that building. On my way to Pittsburg I noticed where they had knocked a hole about six feet square in the rear end of one roundhouse and another place, two feet square, just recently. Last year we had, I think, six cases where we had holes knocked in back walls.

Mr. Hudson.—I do not believe in a concrete wall re-enforced to withstand the butt of an engine. I think it too expensive, for the wall being so far from end of track, an engine would get so much momentum it would take a large mass to stop the engine. I think it would be better to put in a bumping-post on end of track, or still better, to leave a large enough opening in concrete wall to let an engine through and fill this opening with brick.

Mr. Penwell.—Now my idea was to get this wall built out, either on the in or outside. To put in a regular bumping-post inside, the objection would be the increased length of the house for whatever room it takes up. You cannot put on a stop block on the rail of a sufficient height, because

it will strike the pilots in heading in, or if backed in, it will strike the brake beams. I think this can be built right in the wall. Then use a four-inch cast iron stop block. But to put in, as I said before, anything like a regular bumping-post, would necessitate increasing the length of your engine house so much as to make it very expensive.

Mr. Pickering.—In regard to my experience along that line, I have no concrete engine houses under my charge, but have some brick ones, and one engine house where at the back of the house there is a solid gravel bank that comes something like six feet higher than the floor of the house. The underpinning against this bank is of two-foot granite blocks and one of those blocks, some six feet long, has been forced back almost two feet in this solid bank by the engines striking it. This proves to me that it would require a pretty solid re-enforced concrete bumper in there to hold that pressure. I have had some trouble with old brick houses which are not long enough for the present engines that put up there and they have knocked the backs out several times recently. In replacing the holes knocked out, I put in a wooden frame, something like three and a half feet inside, with a door to open on the outside of this frame, and bricked up the wall around it, so that the next time, the draw-head of the locomotive simply knocks open this door, for as a rule an engineer or a hostler, out of fear of the superintendent of motive power, will be very careful not to run his tank against a brick wall, and I find it a very successful arrangement with me.

Mr. Steffens.—This matter of bumping blocks is taken care of by the designers on our road, with a low bumper made of an I-beam anchored to the track. Even with a bumper, the trouble is if a hostler runs an engine into the house at a considerable rate of speed the locomotive will simply jump over the obstruction. Any mass of concrete in a house, as a buffer, means about the same expense as to build a brick wall, whereas the object of re-enforced construction is to minimize the cost. Further than this, no superintendent of motive power will allow a bumper-post

inside of the house, unless it is some low-track device. The suggestion of Mr. Pickering for providing means by which the broken out portion can be replaced is well worth consideration.

Mr. Penwell.—I never thought of Mr. Pickering's plan and I regard it as something well worth considering. It is a good idea, and a plan similar to that would have saved our company several hundred dollars in the last three years.

Mr. Pickering.—I would suggest, as it occurs to me, if we are to build a re-enforced concrete engine house, that the re-enforcement be carried above the point of contact. If you re-enforce from the top to the bottom you will certainly knock out a whole panel, if anything is knocked out, and perhaps very much more, and possibly let a section of your roof down. But if this re-enforcement was to be arched up or carried above the point of contact with your engine and leave the space liable to be struck without this re-enforcement, it might be knocked out readily and replaced at a small cost, with very little material damage to the engine house as a body.

Mr. Killam.—We have been building some eight or ten new houses, costing from $75,000 to $125,000 apiece, and there is no provision made for bumpers anywhere around these buildings, but there is a circular track inside of the outer wall of these houses for trucking heavy material. This track is 21 inches gauge, but it provides against the locomotive striking the wall. There is no other protection and we have had no trouble in the larger buildings.

President.—Gentlemen, it is now 5.30. I would suggest that we adjourn until tomorrow morning and then take up this subject again and get through with it as soon as possible, so we can take up the rest of the subjects.

DISCUSSION RESUMED.

President.—I would like to know if Mr. Tanner has anything to offer on this subject.

Mr. Tanner.—I do n't know that I have much to say. I

might say, however, that the Missouri Pacific has been doing a lot of concrete work for some time, for the last five or six years, and about a year and a half ago constructed a pretty large concrete grain elevator at Kansas City. We used circular bins. The bins are, I think, 42 feet in diameter and some 85 feet high above the track, using altogether re-enforced concrete for it, and amongst other things we have there a concrete smoke-stack made out of re-enforced concrete. It is about 160 or 165 feet high above the track and apparently gives good satisfaction. There is no crack in it that you can see at this time in any part. We have also been using concrete for all kinds of structures, from the smallest to the largest, in the shape of box culverts, concrete arches and other things; in fact, everything that can be made out of concrete. We have a good many platforms; have had some trouble with them on account of being slippery, though possibly that is due to troweling them down too much.

President.—That is all the Missouri Pacific, is it, Mr. Tanner?

Mr. Tanner.—Yes, sir.

Mr. H. H. Eggleston.—We use concrete material in all of our masonry work on the Alton. We put in two very large station platforms of concrete this summer and they are satisfactory in every way. I think that concrete construction has been adopted by nearly every railroad as being the cheapest and the best where masonry is used.

President.—Anything further on this subject? If not, we will pass it.

Mr. Cummin.—Before the subject is closed, I have thought of one question I would like to ask,—as to whether concrete is strictly fireproof, and would like to ask if anybody has had any experience with fire in a concrete building or with concrete floors.

The reason I asked that question, three years ago next December, at Long Island City, we had a station burn down. There was a concrete floor in this station and concrete plat-

forms outside, with a shed covering, and wherever the woodwork and timber fell on that floor the fire seemed to have no effect on it whatever, but wherever the hose was turned on the fire and the water was heated by the burning embers, etc., the concrete was entirely ruined. Now I would like to know if any of the other members have had any experience in that way. Now the point is, where the water had not touched it the concrete was all right, but where the water and heat came together, the concrete was ruined.

Mr. Hudson.—We have a concrete cinder pit faced with vitrified brick, with the exception of the cast chairs. These were encased in concrete and not faced with brick. The water hits them while very hot, which has caused them to crack so badly that we had to cut out the concrete, put in new and encase this in vitrified brick.

Mr. Schall.—My idea is that concrete construction is a fire preventer. If a building is constructed with side walls, floors and joists of concrete, and only the window frames, windows and doors of wood, a fire cannot make headway to do much damage to the concrete; this kind of construction will prevent the fire from spreading.

Mr. Cummin.—What I wanted to bring out was, suppose you have a large fire in a city with narrow streets and you have a concrete building there and the flames from the opposite side of the street get on it and they turn a hose on that building, what is going to be the result? It will ruin the building, undoubtedly.

Mr. Schall.—If the steel does not get hot enough to lose its shape, it will not collapse.

Mr. Large.—We have been using a cinder pit now over a year and a half, anyway. It is entirely concrete. We have been using it right along, and no trouble yet. It was rather a poor job of concrete work in the first place, but otherwise do n't seem to show any signs of giving trouble about the heat and the water.

Mr. Staten.—Mr. President, on our road there is a big cement plant where they manufacture Portland cement, and

they wanted the officials of the road to let them build a concrete station at that point. And they did build a very neat depot and the railroad company was to pay for half of it, and after it was built I heard one of the officials say that he did not have to pay for half because the company could n't afford to.

Mr. Richey.—In my report I steered clear of the cost. It is like those wharfs and docks; it is a variable quantity; it will cost different in different localities; it all depends on the material and labor.

Mr. Clark.—Along the line as to what Mr. Cummin was figuring on, I would say that we have a concrete cinder pit at one of our terminals, and last winter our shops got on fire and partly burned down, cut the water supply off, and in drawing the fire from the engines we had no. water to keep the cinders cool. The consequence was that while this cinder pit is a brick-lined, concrete pit, brick facing up to about four of five inches of the top, all this concrete has disintegrated so much that at the present time we are taking it out and renewing it to the depth of about six inches, thus showing conclusively that concrete will not stand an intense heat, but when the heat did not come in contact with concrete, same was O. K.

President.—If nothing further, we will close this subject and pass to the next one.

IV.

REPORT ON ANCHORS FOR PLOWS AND DERRICKS.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: Your committee selected to report on subject No. 4, viz., Anchors for Plows and Derricks, beg to submit the following report:

By "Anchors for Plows" we presume that reference is made to plows used in unloading earth, cinders or rock, from flat cars. Before air brakes were used it was customary to stop the train and set the hand brakes, when unloading material in one place, and then chain one car to the rail, but since the air brakes are universally used, brakes are usually set on train and locomotive uncoupled and one end of cable attached to locomotive, the other end to the nose of the plow, the cable passing over string of cars to be unloaded, and when unloading on curve cable passes through sheaves or guides to hold it upon the cars; the plow being guided by side stakes on the cars to keep it in center of cars, whether a two-flanged or one-flanged plow be used. The plow is generally weighted down with scrap iron on the rear to hold it down on the car, so that it will not ride up over the material to be unloaded. On most roads the Lidgerwood Rapid Unloader is used, one end of cable being fastened to the plow and the other to the unloader; air brakes are set and no anchor is required. On the A. T. & S. F. Ry., Coast Lines, the Lidgerwood Rapid Unloader is used, and a two-flanged plow, called the Barnhardt Plow, which has a front and rear guide to keep it steadily in the center of the car, the cable being attached by a hinged joint to the front guide. With loose gravel or volcanic cinders, engine can be run from four to six miles per hour in unloading.

Anchors for Derricks.

In the installation of anchors for derricks in stone quarries, where derrick is to be permanent, holes are drilled in rock and eye-bolts with rings are used, the bolts being leaded or cemented in place; wire cables or rope guy lines are stretched from crosshead on top of mast to the ring bolts, which are placed at a suitable distance from the foot of mast, four of these being used generally, except in case of a stiff leg derrick, when two ring-bolts, wire cable and stiff leg are used, the stiff leg being weighted down with rock to keep it in place. Anchors are also sometimes built, where there is nothing but a solid rock surface, out of heavy timbers, framed together, of suitable size like an old-fashioned saw-buck and weighted down wiih sufficient rock to sustain the load or pull of guy-lines. In permanent anchorage it is customary to use masonry—either stone, brick or concrete—of such dimensions and quantity as is necessary to sustain loads put on derrick. For temporary work, such as erecting buildings, bridges or stacks, frame work of structures, etc., where surface is earth, trenches are dug and timbers put in and

buried to such depth as will be required to sustain load. Another method is to use piling. Ring-bolts are used in case of rock surface, bolt being leaded or cemented, as in case of permanent anchorage. In case of anchorage for derrick car, for picking up wrecks, outriggers are placed and car is chained to rail on opposite side from the lift. There are several kinds of anchors for temporary work, such as an iron, with a large I-and-screw blade, similar to a dirt auger and sometimes made with a scoop end. We do not know what satisfaction they give as we have never used them.

We have this point to offer on all derrick anchors where a cable is used: There should be a fixed sheave attached to the fastenings so as to simplify the matter of tightening the guys, so that cable will play freely over the sheaves in order that the slack can easily be taken and the clamps freely adjusted to the cable.

Respectfully submitted,

R. J. AREY,

Chairman of Committee.

DISCUSSION.

Mr. Reid.—I suppose from the subject, "Anchors for Plows," that it refers to anchoring plows for ballast trains. On the Lake Shore we do not anchor plows. We have Lidgerwood unloaders. We have an engine, drum and cable and the plow, of course, is at the rear of the train and this unloader is at the forward end; starting the engine we can distribute the material equally over the train length, or by moving the train along we can put any amount of any kind of material in any place. Before we got this unloader, years ago, we anchored the plows, set all the brakes on the cars in the train, blocked the wheels as well, and then pulled with the locomotive. The cars would frequently begin to slide on the rails, especially where it was down grade and we experienced a great deal of difficulty; but with these unloaders, which are entirely practicable, we have no trouble whatever. The work-train locomotive furnishes the steam, an arrangements that works very nicely.

Mr. H. H. Eggleston.—Our road has used the Lidgerwood for unloading dirt and gravel and it works very well. The bull-dozer spreads the dirt as it is unloaded. The Lidgerwood and plow for unloading and the ballast spreader, have been working on heavy fills all summer, and gave the best of satisfaction.

V.

METHODS OF REPAIRING ROOFS OF VARIOUS KINDS.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

Your committee, after reviewing this subject in a general way and sending out circular letters to a large number of the members of the Association, beg leave to submit the following report:

This subject might seem unimportant at first thought, but when we come to consider the amount of money spent by the various railroads in this particular line of work we conclude it worthy of careful thought and consideration.

The particular surroundings in each case govern largely the method to pursue, but the following suggestions are made, hoping that they will prove beneficial to the members of the Association.

The first requisite is good construction followed by frequent inspection and prompt repairs to small defects. This embodies the most important feature of repairs to roofs.

1. Best method of repairing slate roofs. The most practicable and best way of repairing slate roofs is to remove the broken slate by use of the slate ripper to cut the nails; remove the broken pieces of slate, then use strips of galvanized iron and nail on to the sheathing, allowing this to project about an inch below the bottom of the slate. After the slate has been replaced bend the galvanized strip up over the bottom end of the slate to hold it in place, thus avoiding the use of nails where they will be exposed. No. 26 galvanized iron is most suitable for this purpose.

2. Best method of repairing tin or copper roofs. Repairs are generally made on tin roofs on account of neglect to keep properly painted. When the defects are such that they cannot be remedied with cement, the only method would be the old way of scraping and patching them, covering with a good coat of paint.

Copper roofs are so seldom used on the railroads that we have a limited experience in this line and the conditions will nearly always govern the process with copper roofing.

3. Best method of repairing pitch and gravel roofs. When gravel roofs need repairs, the best and cheapest method is to scrape all the loose gravel in heaps, then inspect the paper thoroughly, making such repairs as are necessary. Cover the new paper with a good coat of pitch, then cover the entire surface with an additional coat, following this with the usual coat of gravel.

Gravel roofs which seem to be beyond repair can often be made as good as new for half the price of a new roof. No roof is worse neglected than a gravel roof, and we would recommend that as soon as the paper begins to show through the pitch in small spots that the new coat of pitch be applied before the roof begins to leak.

4. Best method of repairing ready prepared roofing. In justice to the manufacturer and the company by which we are employed

these roofs should have attention before leaks begin to show and a suitable coat of dressing be applied, thus saving the expense of cutting the paper and patching, which seldom gives satisfaction. In case of bad leaks there is no way but to patch the paper thoroughly and then use the best coating suitable for the patching of the roof.

J. N. Penwell,
A. W. Merrick,
G. C. Larson,
H. W. Phillips,
C. F. Flint,
Floyd Ingram,
Committee.

Bloomington, August 26, 1905.

Mr. J. N. Penwell, Chairman Committee No. 5, Tipton, Ind.:

No. 1: Best method used in repairing slate roofs.

On our road we have a large number of slate roofs, consequently have quite a good deal of repair work to do. In replacing broken slate we use slate ripper and cut nails; pull out broken pieces of slate, then use strips of galvanized iron; nail on to sheeting, slip your slate up in under slate above and bend the galvanized iron strip up over the bottom end of slate, which makes a very good job and no nails are exposed. This galvanized iron should not be heavy, but at the same time strong enough to stay in place when bent over end of slate. This summer we repaired all the roofs on our shop buildings in Bloomington, using copper slate nails on buildings where there were gases and yellow metal nails on buildings where there were no gases to affect the nails. We use copper flashing on first-class buildings, galvanized iron on all other buildings.

No. 2: Best methods used in repairing tin or copper roofs.

The tin roof on our freight house at Alton I repaired by removing the tin and put on an eastern granite roofing over the storage end of the building, and over the office end we repaired the leaks with tin and painted same with one heavy coat of paint.

No. 3: Best method used in repairing pitch or gravel roofs.

On one roof we recently repaired we cleaned off the gravel, which was loose all over the roof, and covered the old felt with eastern granite roofing, which gave us a very good job. This we did in spots on the roof where the old roof was worn out.

No. 4: Best method used in repairing prepared ready roofing.

We have had no occasion to make any repairs to this kind of roofing as yet, and I am not familiar with any roofs that have been repaired within my jurisdiction.

Yours truly,
H. H. Eggleston.

DISCUSSION.

Mr. Penwell.—I received a letter since the report was published which in justice to the writer I feel that I should read to the Convention. The letter referred to is from Mr.

G. Larson of the Chicago, St. Paul, Minneapolis & Omaha Railway.

Letter was thereupon read by Mr. Penwell.

Mr. Penwell.—In making up this report I found that the éntire committee, and all those that we heard from, insisted upon more frequent inspection and earlier repairs. They dwelt more on that than the method to use in making the repairs.

President.—This ought to bring out some good points.

Mr. Penwell.—I should like to hear something about lead flashing on roundhouses. We use copper or lead in making repairs.

Mr. Tanner.—On our roundhouses at Omaha we put on copper flashing around the walls, and in about four or five years it was all eaten out; after that we used common roofing paper, putting on two thicknesses, with the proper amount of pitch, and that stayed.

Mr. Killam.—On the Intercolonial Railway we use lead flashing—20-gauge lead flashing—and have never had any trouble with it. In the new houses being built we are using lead flashings around the windows, dormers and roofs.

Mr. Clark.—We use slate roofs on our depots and freight houses and small buildings; on our roundhouses we use slag roofing. On one roundhouse slag roofing has been on three years without leaks. On our small temporary buildings we have for the last two or three years been using Ruberoid roofing, with a five-year guarantee, and found it to come up to all of our expectations. Where it is properly applied it will last its time—five years. My experience, in regard to these patent roofs, is that it is not so much the roofing material used; but in a great many cases the fault is in preparing the foundations for the roof before putting it on. It is necessary to put almost a tight-jointed roof on before applying the roofing material. Any openings due to use of common boards not tongued and grooved, or shiplapped, will cause a hole cut through your roof along the seams, caused partially from the action of the gases from

below and partly from the action of the elements. In every case I have always tried to get ship-lapped material, not over six inches wide, to cut out all loose knots and lay it as a floor. That will cost something, but I have found that it has paid. The best of these prepared roofing materials, put on boards with one eighth of an inch or one-quarter inch cracks, will not last two years. The principal thing is to secure a good foundation before you apply the roof; then there will be no trouble.

Mr. Cummin.—Can you give us some idea as to the cost of that slag roofing?

Mr. Clark.—I can not, from memory.

Mr. Canty.—Our greatest trouble with roofs is caused by the nails rotting out. There is hardly a roof on the division where I am located where we have not had more or less trouble with defective nails. We had some slate roofs eight to ten years old which we were obliged to relay on account of the nails. My experience with most all of the standard prepared roofings indicates that they would last much longer if composition nails were used. On our slate roofs we have found it expedient to use composition nails, although they are quite expensive. They appear to last longer than anything in this line which I have come in contact with. From my standpoint the nailing is one of the important things about a railroad building roof.

Mr. Perry.—At different points on our road we use the prepared roofing material, which proved to be fairly good roof; but, as another brother says here, it lasts but about five years; then we have to repair the same; but the greatest trouble is on account of the pitch of the roof. I believe where we have a flat roof, say two inches or three inches pitch to the foot, the roof will last twice as long, and will not need repairs as often. A pitch of three inches to the foot will mean better results. We have used copper nails for slating on engine-house roofs, but not on slag roofs. We have engine houses covered with slags but the roof has a pitch of six inches to the foot and there is a tendency to

draw the felt, caused by the steepness. We sheathe our roofs perfectly tight, in order to prevent the sulphur from coming in contact with the nails and covering on the roof.

Mr. Cummin.—I think the members are losing sight of the fact of the question that was brought up. That was in regard to flashing on roundhouses. Have had a little experience in that line myself and if there is any metal made that will make good flashing on a roundhouse I should like to find out what that metal is. We have tried lead, copper, galvanized iron and everything else.

Mr. Penwell.—We have a twenty-five stall roundhouse, also a few ventilators on shop buildings that we are repairing right now. I had a man there for six weeks, two years ago, on the same job and thought everything was all right. It was for the time being, but now the flashing is all gone around the ventilators. In making the repairs I should like to know the very best flashing that can be used. I used some patent roofing for flashing on the roof of a roundhouse where it adjoined a wall and it has worked satisfactorily. If anybody knows of anything better than lead and copper I should like to know what it is.

Mr. Richey.—I had occasion to remove the roof of one of our engine houses erected some 20 years ago, and found the slating nails in a good state of preservation. They were tinned iron nails, and after having been subjected to sulphur fumes for about 20 years they were, with few exceptions, practically as originally driven.

Mr. Cummin.—We are abolishing, as far as we can, on all buildings, hanging gutters of any description, and wherever possible form the gutters in the roof, thus far with very good results.

Mr. Pickering.—Speaking of nails, Brother Canty is confronted with a difficulty that perhaps a good many of the other members are not. On his road, which is the same one with which I am associated, they use coke very largely for fuel. We all know that coal is bad enough on all kinds of metal; but no metal will stand against coke.

Mr. Killam.—On the Intercolonial our new roundhouses do not have any gutters. Our roundhouse roofs are first laid with seasoned $1\frac{1}{2}$-inch or $1\frac{1}{4}$-inch tongue and groove boards, and the specifications provide that all spikes and everything of that kind used in the construction of this roof shall be galvanized. Four-ply paper is used for the roof with Sparham covering. It is considered that a roof properly constructed in this way will last 25 or 30 years. We have never had much trouble on account of the lead flashing, as the roofs are constructed so tight that the vapors cannot reach the flashing. In some of our brick buildings, where the flashing is lead and in service 26 years, flashing is apparently as good as ever. I think that the 20-ounce gauge lead flashing is about the best material possible.

Mr. Cummin.—Would like to ask for my own information if this Sparham that Mr. Killam speaks of makes it last 26 years. I do n't know what this Sparham is.

Mr. Killam.—It is made of asbestos, I believe, with asphalt, tar and a certain amount of pitch. Roofs that I know of that have been on 20 years are apparently as good as ever. Occasionally we give them a brush coat at an expense of about 75 cents or $1.00 a square. We do n't use any slag or gravel—just this material. Should a roof become cracked by the lumber shrinking, a brush coat covers it up. The secret of success is to have plenty of paper, four- or five-ply of the various kinds of felt paper, with the Sparham over it. It makes a perfect roof, costing about $6.00 per square for the roof.

Mr. Canty.—We have used both galvanized and copper nails. My experience is that they do not last much longer than common iron nails. Brass is the only material which we find will last, particularly on engine house roofs. We use brass screws in our wooden smoke jacks, and I have heard of engine house roofs being flashed with very thin sheets of brass.

President.—Anything further on this subject, gentlemen? If not, we will pass to the next subject.

(No report on subject number six.)

VII.

PROTECTION OF WATER TANKS AND WATER PIPES FROM ACTION OF FROST.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

Your committee issued a circular of inquiry on March 24, 1905, which was distributed to members of the Association in the northern portion of the United States and Canada. Thirty-eight replies were received, many of which contained valuable information and all indicated considerable interest on the part of members to assist in the work. The committee takes this opportunity to thank all contributors for their assistance.

It appearing impractical to specify any particular outfit which would be proper for all locations, your committee thought it advisable to print extracts of the circular of inquiry and replies to same so that each member of the Association may have full information on methods used and thereby be able to pick out from the different descriptions such data as will be suitable for his needs.

EXTRACT FROM CIRCULAR OF INQUIRY.

The Committee on "Protection of Water Tanks and Water Pipes from Action of Frost," desiring to make a thorough report, requests that you aid them as far as possible by answering the following questions. We have taken for granted that the above mentioned subject refers to locomotive water outfits only:

1. Do you use any method to heat water in tanks in order to prevent freezing? If so, please describe same.

2. Do you use any scheme other than an air space to protect tanks on top and bottom from action of frost? If so, please give description.

3. Describe best way, in your opinion, to obtain an air space on top and bottom of locomotive water supply tanks.

4. Have you ever found it advisable to protect side of tank from action of frost?

5. Do you advise connecting pipes from pump or other source of supply so as to deliver into discharge pipe between tank and standpipe and thereby keep water in discharge pipe in circulation in place of delivering supply directly into tank?

6. Where you use steam pumps, do you turn the exhaust steam into the suction pipe?

7. Where water is delivered directly from tank to locomotive without use of standpipe, what precautions are used to protect outlet valve and spout from freezing?

8. In tanks where float valves are used, what precautions are taken to keep float and valve operating properly in winter and where do you place the valve which is operated by a float?

9. What do you consider the best scheme for protecting pipes between ground and floor of tank from action of frost?

Any other information bearing on the subject which you may be able to contribute will be appreciated.

EXTRACTS FROM LETTERS RECEIVED IN ANSWER TO CIRCULAR INQUIRY.

G. Aldrich, Supervisor Bridges and Buildings, New York, New Haven and Hartford R. R. Company:

1. No.

2. No.

3. On bottom, by sheathing up on under side of timbers which support the tank and putting a facia on the ends and sides of same timbers. This serves two purposes: first to close up open space; second, to form a finish. On top, the air space is obtained by sheathing up on top of tank.

4. No.

5. It is not necessary if pipes leading to standpipe are placed below frost line.

6. No.

7. The valves are of the clapper pattern and placed in centre of tank bottom and operated by chain over pulleys at the top and down the outside. Being under water and in centre of tank the frost does not affect them. The spout is arranged with a counter-balance weight so as to raise it to a perpendicular position after locomotives have taken water, which will allow all water left in spout to drain out of lower end.

8. We place float valves as near centre as possible and have no trouble in winter about their operation. We always use a B. B. Ball cock.

9. We sheathe up inside and outside of the four centre posts, from the ground to the bottom of the tank, which leaves an air space of about ten inches. Where there is not much water used we sometimes make another air space outside of the first one. In some cases we have filled the outside space with shavings and made it solid on the outside. I am inclined to think that the two air spaces are better. I think there is nothing like an air space.

W. E. Alexander, Supervisor of Bridges and Buildings, Bangor and Aroostook R. R.:

1. Yes, we use exhaust steam to heat water where steam pumps are used, which is very satisfactory, by condensing steam into a barrel and taking heated water into suction pipe close to pump. In some cases we take hot water from gasolene pumping engines in the same way. In many cases we enclose substructure under tank with matched boards, paper and clapboards, and put good coal stove under tank with a six-inch wrought-iron pipe up through tank, which serves as a stovepipe and also to heat water. This is also very satisfactory, as ice can be kept out of tank, and valves and pipes are all kept warm.

2. On top of tank we do not use anything but the roof. No air space except in some small tanks. Most of the small tanks we enclose in a house where we have a stove and keep warm in winter. Where the four centre posts under tanks are enclosed, and air space made under bottom of tank, we use a B. & H. lamp with sheet iron top for heater, which does quite well in protecting inlet pipe and valves, but does not keep ice out of tank and does not protect outlet pipe much. Stove under tank, as mentioned above, is much the best.

3. We do not find air space at top and bottom of tanks of much use without heat; with heat they do not seem needed.

4. We find best way with small tanks to build a house over them. Large tanks do not need any protection where heat is put in water, which is cheapest and best.

5. We use one pipe from ground to tank and connect discharge from pump at nearest point.

6. Yes, we turn exhaust into suction pipe. In most cases we turn exhaust into a tight oil barrel, which is kept in pump house with gauge glass to show water level. The barrel is kept about half full of water with a ¾-inch or 1-inch pipe from bottom of barrel tapped into suction pipe near pump, with valve in small pipe to regulate water in barrel. Also a ¾-inch pipe from discharge pipe to upper part of exhaust pipe above barrel, so running water condenses steam going to barrel. Exhaust pipe should not go into water in barrel. We use barrel on side mostly, but it may be placed in any position required. With valves in exhaust pipe, we turn exhaust into barrel, or out in the atmosphere as required. This arrangement is very satisfactory, as pumps will throw as much or more water with the same steam pressure with exhaust into barrel, and will keep tanks and pipes clear of ice with ordinary use of pump.

7. As described in answer to question No. 1. It is very satisfactory.

8. We only use float valves in small tanks inside of buildings where we have no ice. Valve in pipe outside of tank.

9. As described in answer to question No. 1, I consider the best protection is to have substructure enclosed with stove under tank. Where we have the four centre posts enclosed we use a H. & B. lamp with sheet iron top for oil heater, which answers very well. Where exhaust is put into water, pipe may be well boxed with air spaces, so no more heat is needed.

L. J. Anderson, Foreman of Bridges and Buildings, Chicago & Northwestern Railway:

1. We use steam direct from our boiler into the bottom of tank. A three-quarter inch pipe runs alongside of the discharge pipe under ground and up through the frost box, through the bottom of tank and about eight inches above bottom, inside, with an ell and a common check valve. When the steam is turned on, it opens the check and admits steam direct into water. When the steam is turned off, the water pressure in the tank closes the check and then the drain in the pump house is opened to drain the pipe. Where the distance is too great, we put heater pipe into the discharge pipe in the pump house, using a check valve near the discharge pipe. This would also have to be done where the ground is wet, as the steam would condense and do no good in the tank. Do not use exhaust steam for heating. Where the exhaust pipe is attached to the discharge pipe, it checks the pump and if the pressure is greater in the discharge pipe than on the boiler your pump will not run. Where heaters of this kind are used with direct steam we have never had ice in our tanks nor frozen outlet pipes.

2. None on the bottom of tank and only the double flooring and roof on top.

3. Double boards and paper under joists is good as long as the bottom is tight, but it is no good if the bottom leaks and water gets in between.

4. No, our heater pipe system does away with that.

5. We deliver direct into the tank and our standpipe mains are below frost. If discharge pipe is connected to standpipe main and an accident happens to the standpipe you cannot pump into the tank unless you have an extra valve close to the standpipe to shut off.

6. No, we think it leaves a chance of letting air into the suction pipe and requires too many valves and turns in the exhaust pipe for the amount of good it would do, if any.

7. The heater pipes in our tanks do away with all freezing of outlet pipes when rightly used, as the water takes the chill out of the iron, while the engine is taking water, but if the valve leaks a little the outlet pipe may freeze, and to do away with that there is a connection in the heater pipe under the tank, so that a hose may be put on and have the outlet pipe thawed out. Cases of this nature are rare.

8. Where we use them, float valves are placed on top of the pipe about two feet below water in the tank, and lever so arranged that ball or float shuts off tight when the water is that height above the valve. This method, as the valve gradually closes, makes a strong circulation on the surface for some time. Float valves on the bottom of tank with chain and float get out of repair much more frequently than where the valve is higher up in tank. The latter can be repaired through a trap in the ceiling without emptying tank. Where valves are in the bottom of tank the water has to be all let out before repairs can be made.

9. A well built air space.

E. B. Ashby, Engineer Maintenance of Way, Lehigh Valley R. R.:

1. No.

2. Air space only, but we enclose tank support at particularly bad points and keep fire in stove underneath.

3. Double roof and bottom.

4. No.

5. No.

6. No.

7. We pack around the spout and carry stovepipe from stove underneath as close as convenient.

8. We do nothing but provide watchers.

9. Box around pipes and fill with sawdust.

S. D. Bailey, Division Foreman of Buildings, Michigan Central R. R.:

1. No.

2. No.

3. In tanks on this road, all we use is a matched 7-8 inch floor on main joists and roof joists are floored on top and ceiled underneath.

4. No.

5. I think one pipe leading into and from tank is the best plan, where practicable, but where water is taken from city pipes this cannot be done.

6. No.

7. We are not using any of this style water spouts at present; when we were using them, we enclosed the goose-neck and pipe in a box filled with sawdust, and when frozen up we thawed them out with hot irons. This happened quite frequently.

8. Where we use automatic valves, we place them near the centre of the tank, from 18 to 24 inches from bottom, with a galvanized iron float fastened to the roof joists, with chain connections from the valve to the float.

9. I consider that the best protection for water pipes leading from ground to tank is a box made of good dry ceiling covered with two layers of tarred paper with an air space, then two more layers of paper and another cover of ceiling or boards and battens. This is all we use in this cold country.

J. S. Brown, Division Engineer, New York, New Haven and Hartford Railroad Company:

1. No.

2. No.

3. We place timbers across top of tank for air space and sheathe them over on upper and under sides. For the bottom of tank we sheathe the under side and around the edges of floor timber.

4. No.

5. Yes, we would advise connecting supply pipe with discharge at some point near standpipe.

6. No, but would advise turning it into delivery pipe at some point between pump and tank. I think this arrangement would be less likely to interfere with the working of pump.

7. None, although we have been troubled some by freezing.

8. Float valves are placed at top of tank and we have had no trouble in keeping them operating satisfactorily in winter.

9. Air space secured by sheathing both inside and outside the space enclosed by four of the posts supporting the tank. This gives an air space having a width equal the dimensions of posts, which could be subdivided by using one or more additional walls if desired.

With reference to question No. 1, we have one 60,000-gallon tank which is supplied by steam pump, and the boiler which furnishes steam to operate this pump is located under the tank. This was done, not on account of any trouble from freezing at that point, but simply as a matter of convenience to avoid having an additional building. Judging, however, from our experience since making this arrangement, the heat from the boiler would doubtless prevent freezing in any part of the tank, even in the coldest climate. It seems to me that such an arrangement would be advantageous where there is considerable trouble from frost. At the point referred to, the bottom of tank is about 16 feet above ground and the sides are sheathed from the ground up to the bottom of tank, making a boiler and pump house of the space under tank. The smoke pipe in this case is carried nearly horizontal from boiler to a stack just outside of tank, although we think a cast iron pipe carried straight up through the tank might, with proper precaution, prove satisfactory. This would no doubt be cheaper than providing a separate stack.

R. J. Bruce, Inspector of Maintenance of Way, St. Louis & San Francisco Railroad:

1. I have used a $\frac{3}{4}$-inch pipe coiled around centre post, supplied with steam from pump boiler and found it assisted greatly in keeping water from freezing. This is in Chicago.

2. Nothing but an air space and this according to climate.

3. Ceil underneath rafters after having tacked a layer of two-ply tarred prepared roofing and, if hatchway is kept closed, it makes a good air space. To attempt to make an air space under tank will result in decayed timbers unless the tank is absolutely water tight, which is seldom the case. Better house the supports in altogether.

4. Never have protected side, however, it would be advisable in cold climate and could be done by tacking 2-inch x 4-inch blocks around tank and over this bind 1 x 4's and to this nail sheathing ripped together to fit, thus forming an air space.

5. I would not advise this. Better cover all pipes sufficiently to start with.

6. Never do.

7. Have used stoves with pipe leading to an outlet pipe, also have used a lamp made to fit. Have used steam from pump boiler. Pump houses should be located close to tank and standpipes where practicable and the steam may be used to overcome all the difficulties arising from cold weather.

9. Air spaces.

Chas. Carr, Superintendent of Buildings, Michigan Central Railroad Company:

1. We do not heat water in tanks to prevent freezing.

2. Do not use air space or any other scheme to protect bottom and top from freezing.

3. By ceiling below tub joists, and ceiling above and below chime joists.

4. No.

5. Yes.

6. No.

7. We use standpipes exclusively.

8. We place float valve about one foot above bottom of tub; the raising and lowering of water in tub prevents float from freezing.

9. We protect pipes between ground and bottom of tank with three separate boxes, constructed of ceiling lined with tarred paper, with air spaces between the boxes; we have never had a freeze-up since this method was adopted.

F. O. Draper, Supervisor Bridges and Buildings, Illinois Central Railroad:

1. Where I have large tanks and pumps I run the exhaust pipe through the tub, which keeps the water at a temperature that does not freeze. In the small tubs I use a cast water-tight smoke stack with stove underneath.

2. I use nothing, only ceiling the floor joists of the tub underneath the roof.

3. By connecting a $\frac{3}{4}$-inch gas pipe to valve and up through the tank. This will allow the water to flow through the goose-neck at full capacity.

4. I have never found it advisable to protect the side of water tanks from action of frost.

5. I would not recommend connecting the pump to the discharge line of tank leading to the penstock, for the reason as soon as the penstock is opened, this releases the pressure from the pump, causing it to pound terribly and is apt to cause a serious breakdown. I would recommend that the pump be connected direct with the tank in order to keep an even pressure on the pump.

6. No, through the tube or where I have a sump.

7. First wrapping with heavy felt paper and then putting a tight box around the goose neck and up against the floor of the tub.

8. I place the valve near the centre of tank as possible.

9. First see that your floor joists are sealed air tight to the tub and then wrap with heavy felt and build frost box with three air chambers and wrap with heavy felt. I would, however, suggest that wherever you have sumps, and can put in an overflow pipe you will find that it will give you good results in the winter as to keeping the water from freezing, as it gives it a good circulation.

H. W. Eggleston, Supervisor of Bridges and Buildings, Chicago and Alton Railway Company:

1. We do not heat water in tanks or use any precaution to keep water from freezing other than the usual air space in tanks.

2. We do not have any scheme other than an air space to protect tanks on bottom and top from the action of frost and we have never had any tanks freeze up.

3. The best method I know of to obtain an air space on top and bottom of tanks is by ceiling and using building paper. We have obtained very good results in this manner.

4. We have never found it advisable to protect side of tank from action of frost.

5. I do not believe there is any benefit obtained by connecting discharge from the pump into supply line between standpipe and the tank to keep water in circulation. We put our pipe far enough in the ground to keep it from freezing.

6. We do not turn exhaust steam into the suction pipe.

7. Where water is delivered directly from tank to locomotive without use of standpipe, we use no precautions, as I am familiar with none that would be effective, except a frost plug, which is placed in the back of delivery pipe, out of which the water drips, but in extremely cold weather this would freeze up to a certain extent and would have to be thawed out by water station attendant. I have never seen any that were fully effective in very cold weather.

8. In tanks where float valves are used, the valve is frequently placed near the bottom of the tank and float, of course, on top of the water and as we have a great many trains on our line, the water in tank never freezes, consequently we never have any trouble with the float.

9. We build double frost boxes around our standpipes and feed pipe to and from tank, and then line both sides with paper. We have never had pipes freeze when protected in this manner.

W. O. Eggleston, Travelling Bridge Inspector, Erie Railroad:

1. No.

2. No.

3. By ceiling over top joist and placing hollow tile frost-proof box under tank around pipes.

4. No.

5. I do not know of any case where water is pumped through discharge pipe from tank to standpipe in order to keep a circulation in pipe line. It might be a good method in excessive cold weather.

6. No.

7. None.

8. Locate valve in frost-proof box only.

9. The best protection is to enclose pipes with a hollow tile, frost-proof box. Space between tile walls, 4 inches.

F. P. Gutelius, Engineer Maintenance of Way, Canadian Pacific Railway Company:

1. We find it necessary to use heat to prevent water from freezing in all tanks on the system except those on the Pacific coast. Numerous methods are used,—

(a) To extend the smoke pipe from the stove under the tank through the bottom of the tank so that the water in the tank is in direct contact with this pipe. In many cases smoke pipe leads from the pump boiler, which is placed underneath the tank; in others a heating stove is used.

(b) When pump is located sufficiently near the tank, the exhaust pipe from the pump is extended into the tank and steam from the pump passes through this pipe, which is a coil, located as shown on plan of enclosed tank.

(c) The substructure of the tank in many instances is a 30-inch stone wall, which keeps the bottom of the tank warm without the use of steam. In severe winters, however, this is not sufficient to prevent ice in tank.

(d) Our new standard tank encloses the entire structure and is sufficiently large to give workmen access to the bands.

2. As above.

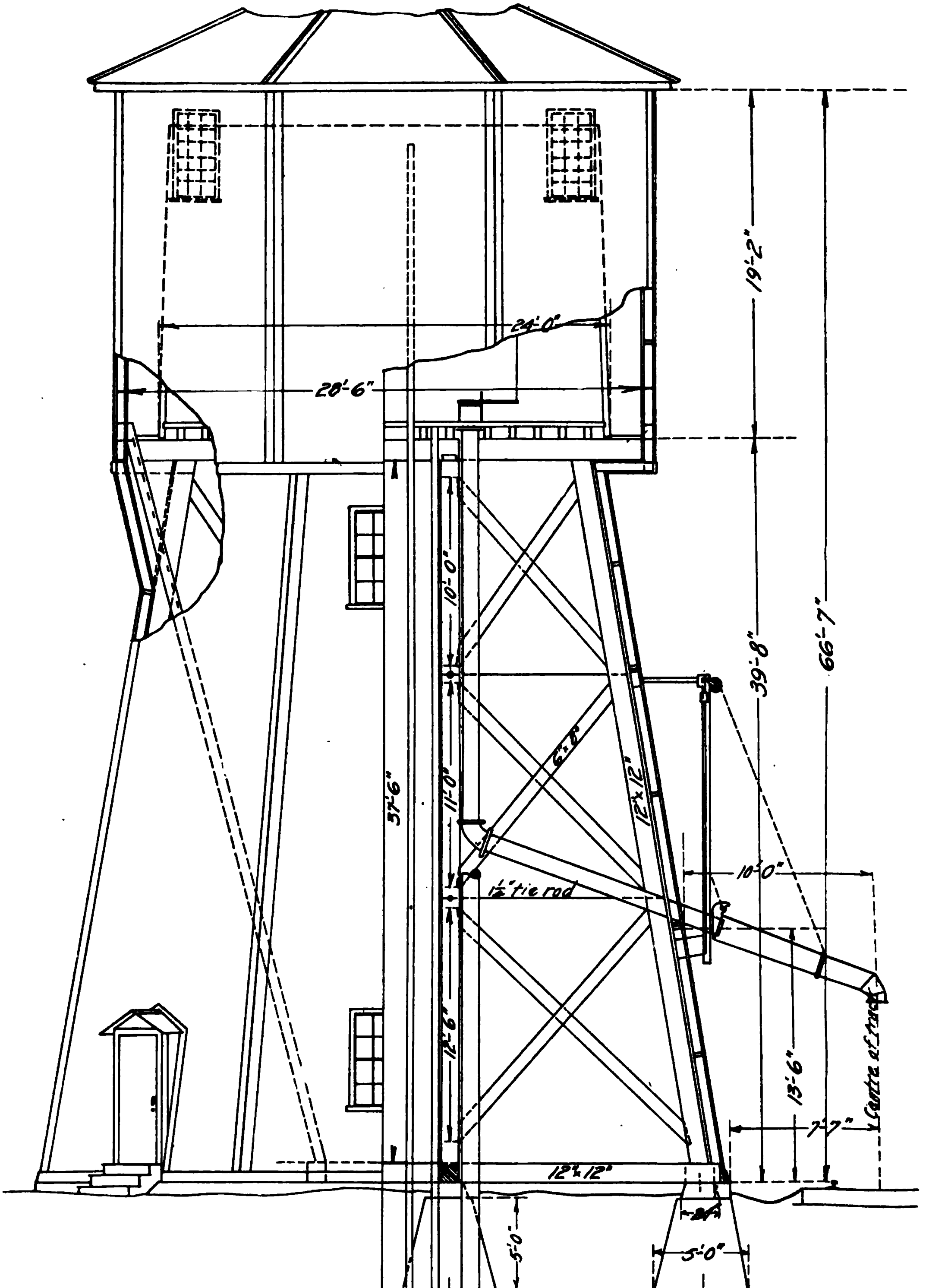


FIG. 42.—Standard High Tank, C. P. R.

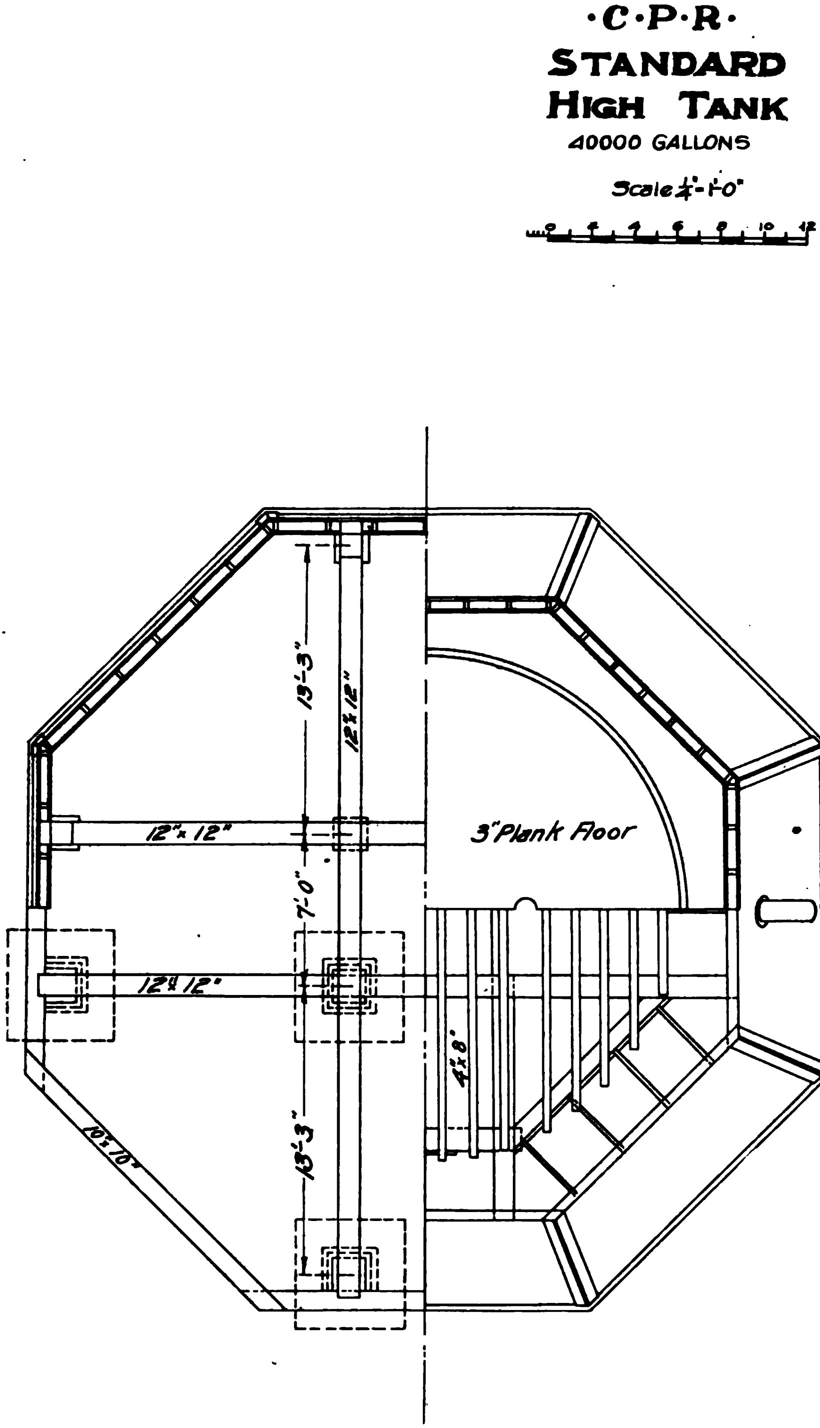


FIG. 48.—Standard High Tank, C. P. R.

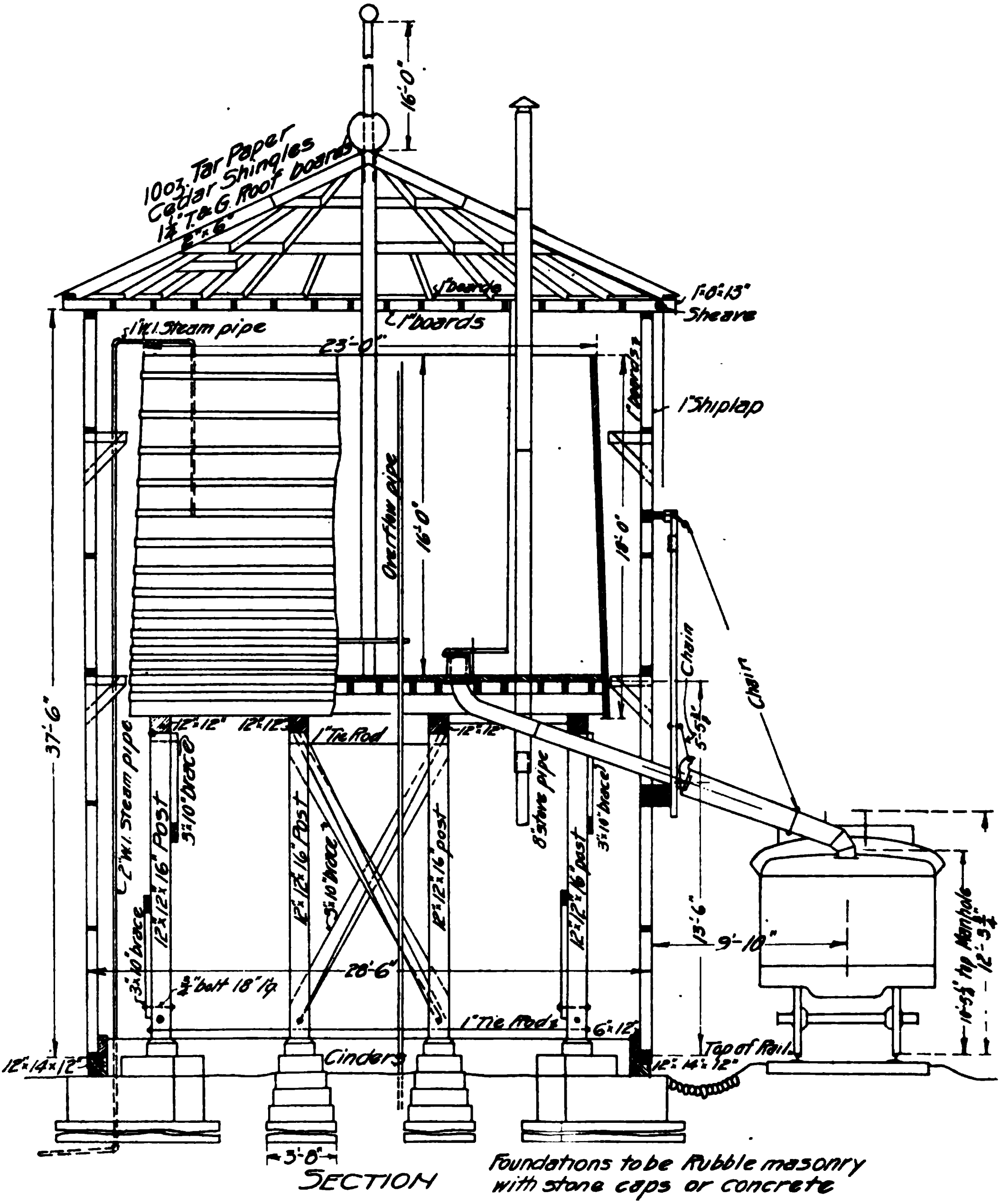


FIG. 44.—Standard Enclosed Tank, C. P. R.

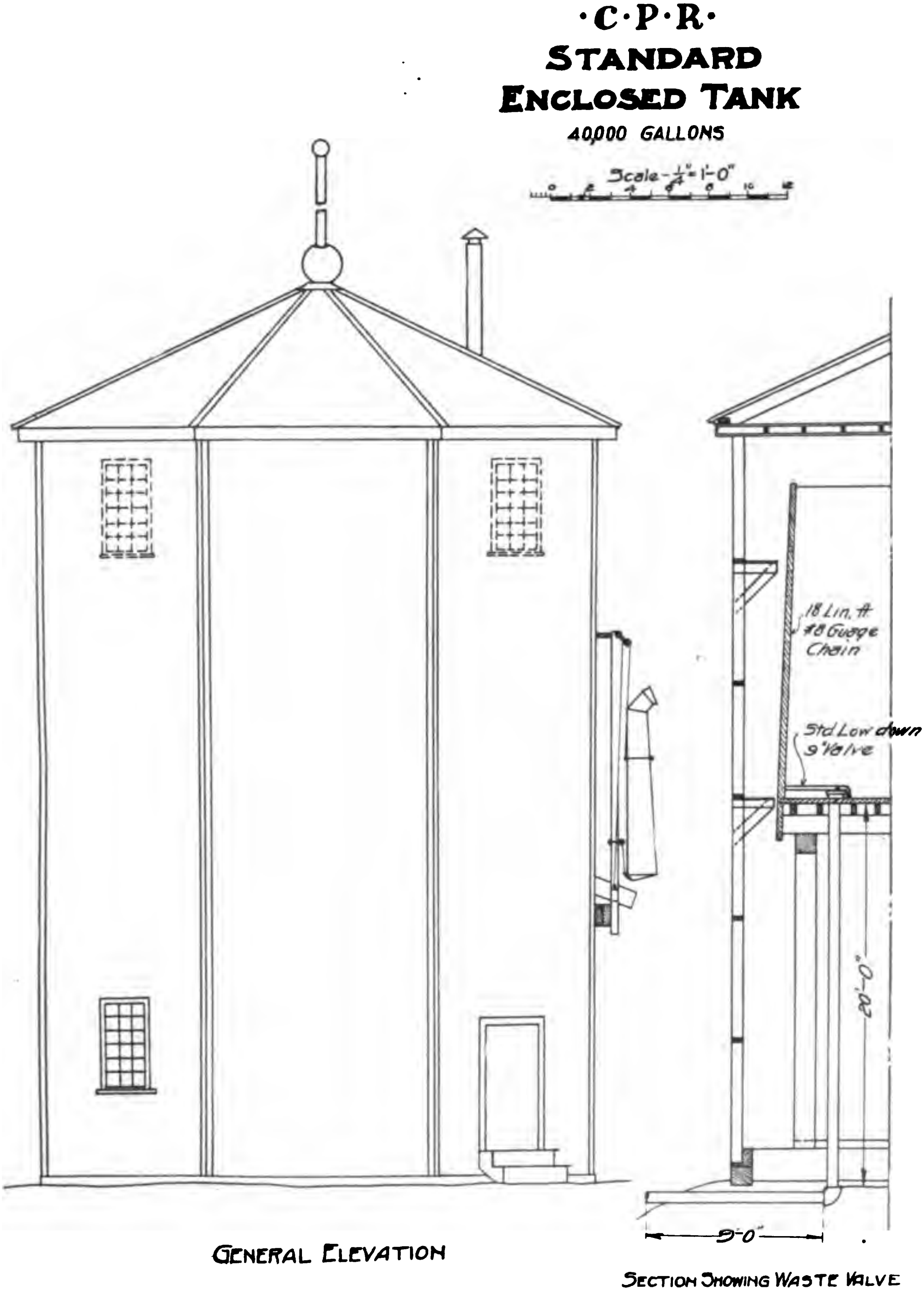


FIG. 45.—Standard Enclosed Tank, C. P. R.

3. By enclosing tank as above described.

4. It is necessary in Canada generally to protect the side of the tank, and we think it can best be done as per our standard enclosed tank.

5. We lay our pipes leading to standpipes at sufficient depths so that there is no necessity for making special effort to connect supply pipe into the large pipe leading from the tank to the standpipe. If, however, any length of supply pipe can be saved, we connect the supply pipe to the large pipe leading to the standpipe in preference to extending it to the tank proper.

6. We do not turn exhaust steam into the suction pipe. There might be a few cases on the system where this method of heating would be satisfactory, but as a general proposition it is not approved.

7. In our enclosed tank the outlet valve is located near the centre of tank, so that cold air entering the goose-neck is usually not sufficient to freeze up the valve.

8. The enclosed tank prevents the formation of ice in the tank, so that the float valve is not interfered with in the winter.

9. In the enclosed tank we do not require any protection for the pipes leading from the ground to the floor of the tank.

Our standard enclosed tank is giving first-class satisfaction except for the accumulation of ice on the track, caused by water being wasted when locomotives are being supplied. It would be interesting to us, therefore, if the discussion on this subject would give us an idea as to how this difficulty might be overcome.

H. A. Horning, Division Foreman of Buildings, Michigan Central Railroad Company:

1. No.

2. No.

3. We have very little trouble in this line, and consequently make no provisions other than a natural air space between sheetings, using building paper.

4. No.

5. We, as far as possible, and most cases are possible, connect discharge pipe from pump and from tank in the vicinity of the water supply tank, making only one connection to the tank. We do not, however, consider it advisable to connect discharge pipe from pump to the standpipe line when standpipes are located near. The connecting of standpipes on discharge from pump, when steam pumps are used, is very detrimental but where other pumps are connected by belt or direct connection is used and operated under a governor, the defect is somewhat overcome. We have very little trouble in the freezing of discharge pipes, other than from the ground to the tank, and we endeavor to protect this section by air-spaced boxing.

6. No.

7. We, in all cases, dispense with the direct tank spouts. We have in the past found them to be troublesome, and recommend the using of a standard standpipe, which may be placed at a convenient point close by.

8. In placing float in water tanks, it is always practicable to locate them at some distance from edge of tank, as more or less frost gathers on staves during the winter. If located near the centre, they will give little trouble from action of the ice, as water is not at the same height long enough to allow float to freeze fast.

9. We have had some trouble in the way of frost referred to in question No. 9, in fact the majority of trouble we have with pipe lines, other than standpipes, are from this cause. We have tried various ways to overcome this trouble, and have adopted an air-space box, composed of at least four thicknesses of seven-eighths sheeting and as many thicknesses of good building paper. We extend this box to at least three feet below the surface of the ground and connect it to the bottom of tank as securely as possible; also sheet over bottom joists from outside of boxing to the first beams and place tight girts between joists in the best possible manner to protect this section of pipe. We do not consider it advisable to use sawdust, mineral wool or other substances, as we consider the air space equal, if not better, than any of these.

J. E. Johnson, Supervisor of Bridges and Buildings, Rutland Railroad Company:

1. No.

2. No.

3. The best method I have found is to make three air spaces.

4. No.

5. No, I think it unnecessary when pipes can be put below frost.

6. No. Most stations are gravity supply here. We do so, however, in West, and consider it a desirable scheme. A grease extractor should be provided to be attached on exhaust just as it leaves pump, to prevent all grease possible passing into tank.

7. We provide local freights with steam hose and, when necessary, they use steam to clean out goose-necks as well as base of tank spouts.

8. We put the automatic valve near bottom of tank, say four feet up, and use rod with float at top. Have no trouble with this arrangement.

9. We triple frost proof, that is, our posts are seven feet centres and we sheet with 7-8-inch inside of the four centre posts, at the outside of same and centre, making two 5½-inch air spaces, well protected with tarred paper. We then wrap the pipes well with the same kind of paper. The proofing is carried five feet under ground. Doors opening into frost proof are double, built on the refrigerator style and kept closed. We have no difficulty. Narrow material

should be used for frost proofing to prevent, as much as possible, shrinkage at tongues and grooves. At the floor joists the frost proofing should be carried to tank bottom and well protected with paper to absolutely shut any possible opening. In the winter our automatic valves are set so they cannot entirely close, and large overflow pipes are provided that connect with drain so that at all times a circulation is provided in feed pipe where we have gravity stations and take from village or city water works.

We have from four to six feet of frost to contend with so that with the protection mentioned we have not had any tanks close on us the last winter.

W. H. Keen, Supervisor of Bridges and Buildings, New York, New Haven and Hartford Railroad Company:

1. We are not using any method to heat water in tanks.

2. Do not use any scheme other than air space to protect top and bottom from action of frost.

3. We are sheathing top of tank, also bottom on underside of floor beams and find it very effective.

4. Have never found it advisable to protect side of tank from action of frost.

5. We have never made any connection with pipes as stated and cannot advise.

6. Do not turn exhaust steam into suction pipe.

7. We are boxing the outlet pipe from where it is connected with bottom of tank to near the end where spout is connected, using Poage valve and have no trouble as regards freezing.

8. In tanks where float valves are used we have taken no precautions. We place the float and valve in top of tank at end of inlet pipe.

9. Have been in the habit of placing a box around the pipes about two or three feet square and filling it with sawdust. Outside of this, we place another boxing with a space of about two or two and one half feet. This is sheathed outside and having an air space of about six inches, gives good satisfaction and we have no trouble from freezing.

C. M. Large, Master Carpenter, Pennsylvania Company:

1. No.

2. We do not use any air space either at top or bottom of tank and the only protection on top is board roof with the joints covered with 3-inch battens.

3. The best way, in my opinion, to obtain an air space on top and underneath any tank, would be by using boards and tarred paper, setting them about three inches apart and making as many of them as desired.

4. We have not found it necessary to protect the staves from frost.

5. It is our custom to deliver water into tank direct from pump.

6. We do not connect the exhaust pipe into the suction pipe of pumps.

7. I am happy to say that there is only one tank on the E. & A. Division where the water is taken directly from the tank to the locomotive. We have a hole drilled at the back end of the pipe for the waste water to drip out. The pipe is boxed up and covered with tarred paper, but we still have trouble, as the valve freezes to the seat, and then when broken loose, to get water, the ice makes the seat rough and it will leak and fill up the pipe.

8. We set our valve about two feet from the bottom of the tank and connect it to the float with an iron rod.

9. We put all our pipes from the ground to the bottom of the tank in the centre of same, and use four thicknesses of matched sheathing and tarred paper, making three air spaces about three inches each, which when fitted up to the bottom of the tank and a little sawdust put around on the ground, it protects everything nicely. As our climate is not extremely cold for more than a week at a time and never goes below 20 degrees, we have been able to keep our tanks from freezing to such an extent as to make them inoperative. But, I am of the opinion that it would be profitable to cover the top of the tanks and have at least two air spaces, as we occasionally have trouble with the ice forming in the tanks and interfering with the floats, which open and close the valve in the supply pipes, also float for indicator and electric bells. In opening the tanks in the winter I have found several inches of ice around the sides, on the bottom and around the chimes, but never found it on the bottom near centre of tanks. When water is seldom taken from tanks it forms quite heavy on top.

E. N. Layfield, Chief Engineer, Chicago Terminal Transfer Railroad Company:

1. We do not use any method of heating water in tanks to prevent freezing.

2. We do not use any air space or other method to protect the tanks on the bottom and top from action of frost.

3. As stated in answer to question No. 2, we have not used any method of protecting top and bottom and therefore have had no experience as to the relative merits of the different ways.

4. We have not found it necessary to protect the side of tanks from action of frost.

5. We have never tried the method of keeping the water in circulation, as we have not found it necessary.

6. We do not turn the exhaust steam from pumps into the suction pipes.

7. We have not devised any method of preventing the freezing of the outlet valve and spout. We have had some trouble at some of our plants occasioned by the freezing of the water at the spout and intend to try to find some method of preventing it, but have not as yet made any experiments in this direction.

8. We do not take any particular precautions to keep the float valve operating. When the water in the tank is covered with ice, the float simply goes up and down with the ice the same as it would do when floating on the water.

9. We protect our pipes between the ground and the floor of the tank with frost-proof boxing with two 2-inch air spaces and a layer of tarred paper on each of the inside walls of air spaces. We run this frost-proof boxing down into the ground to the frost line.

G. F. Loweth, Engineer and Superintendent of Bridges and Buildings; W. H. LaFountain, Assistant Superintendent of Bridges and Buildings, Chicago, Milwaukee and St. Paul Railway Company:

1. Ordinarily no provision is made for heating water in our tanks. In isolated cases where little water is used, circulation small and temperature very low, tanks are housed and stoves used under them to keep valve from freezing and ice from accumulating in the tank.

2. No air space is provided on the bottom of our tanks. We have found the air space objectionable on account of rotting the structure. No air space is provided on top of tank except that which roof forms.

3. Air spaces are not considered necessary or effective.

4. No.

5. We find no objection to connecting discharge pipes from pump into delivery pipe from tank to standpipe, especially where pumping is done by gasolene engine power. In the use of steam pumps the tendency is for the pump to race while the water is being taken into standpipe, which is not considered positively objectionable.

6. Exhaust steam is turned into the suction pipe of the pumps with good effect where there is trouble with ice in the tanks. This is not considered necessary where the supply is from wells, as well water is much warmer than river water.

7. Outlet tank valves are protected from frost by discharging water directly on them or close to them. In addition they are protected by the pipe box, which is so located as to protect both pipes and the outlet valve.

8. Float valves are not used except where tanks can be kept free of ice.

9. The most satisfactory pipe box we have used for protection of pipe under tanks is that made of kiln dried one-inch boards D & M, in four to six thicknesses, with air space between each, each thickness of boards being covered with a course of tarred-roofing felt.

W. A. Lydston, Supervisor Bridges and Buildings, Boston & Maine Railroad:

1. No.

2. No.

3. Roof and floor over top of tank and double box around the pipes, made of matched pine sheathing, I find ample protection for tank and pipes.

4. No.

5. We deliver the supply directly into tank.

6. We do not turn the exhaust into the suction pipe.

7. Have had little trouble with the outlet valve and spout freezing where water is taken directly from tanks.

8. Where floats are used float is placed about one foot from top of tank and valve in pipe in frost-proof box where it is handy to get at.

9. With double sheathing and paper between on outside and single inside, we have had no frozen pipes from ground to tank.

W. A. McGonagle, First Vice-President, Duluth, Missabe & Northern Railway Co:

1. No.

2. No.

3. Our method is to use dressed and matched fencing with furring strips and tarred felt; the dead air space thus formed has always been sufficient to give us a protection against frost.

4. No.

5. Yes.

6. No.

7. Exhaust steam from pump is used in severe weather to keep the outlet valve and spout clear of ice.

8. Find it difficult to keep the float valves operating properly in severe weather. The only method that we use is to keep the ice broken as far as possible.

9. Our plan is to construct from three to five dead air spaces between the outside sheathing and the water pipes, depending upon the exposure of the tank to the action of the weather. The discharge pipe from pump to water tank is boxed and protected with dead air spaces, the same as described above. We have found this to be cheaper to construct and very much cheaper to maintain than when pipes are buried in the ground.

A. W. Merrick, Division Engineer, Chicago & Northwestern Railway Company:

1. No.

2. See drawing.

3. See drawing.

4. No.

5. No.

6. No.

7. See drawing

8. We have a float valve in operation at one point where the tank is about 1,100 feet from the gasolene engine and pump. The main outlet valve is in the centre of the tank floor. The valve operated by float is about 19 inches from c. to c. from main outlet valve and is in floor of tank at the end of four-inch supply pipe. An eighteen-inch keg float is attached to lever of the four-inch valve by a wire. When the float reaches top of tank the wire is drawn taut and closes valve at end of supply pipe. At the other end of the supply pipe, just beyond the air chamber of pump, is an automatic engine stop. This is a small relief valve connected by a rod to the switch board in the engine room above pump. Pressure on the valve raises the rod which opens the switch and cuts off the current from the gasolene engine.

9. See drawing of Chicago & Northwestern Railroad standard tank under subject No. 6, Proceedings of the Eleventh Annual Convention of the Association of Railway Superintendents of Bridges and Buildings.

A. F. Miller, Master Carpenter, Pennsylvania Company:

1. No.

2. No.

4. I have never found it advisable to protect side of tanks from frost.

5. In my opinion the plan of connecting pipes from pump to direct delivery into discharge pipes is a good proposition, while on this division we have separate supply and discharge pipes.

6. We do not turn exhaust steam into suction pipe.

7. Where we deliver water directly from tank to locomotive, we box the standpipe and also under portion of tank directly under the outlet to prevent freezing.

8. In tanks where float valves are used, the automatic float valve is placed near the centre of tank and eight feet above floor, depending entirely upon the pressure of supply pipe.

9. In my opinion, regarding the best scheme for protecting pipes between ground and floor of tank from action of frost, it is best to

build two air chambers of twelve and eighteen inches respectively, protected on both sides by partitions and lined with heavy felt paper to prevent from freezing. I have had no trouble with this method of protection to the pipes leading to and from tank, and it is a decided improvement over old method of boxed pipes, enclosed with sawdust in a double partition box.

R. P. Mills, Supervisor of Bridges and Buildings, New York Central and Hudson River R. R. Co:

1. We have not found it necessary to make any provision against tanks freezing, as the ice accumulating on the top and bottom and side of tanks does not amount to anything. However, in some instances, we have found it necessary to place a stove under tanks to keep water pipes from freezing; and when we have done this, I have run a cast iron pipe up through the tank which answers for a smoke flue and at the same time keeps the water from freezing. We get very good results from this method.

2. No.

3. I do not consider any necessary.

4. No.

5. I find it a very good practice to connect the discharge pipe from pumps directly into the discharge pipes from the tanks. This keeps the water in circulation and prevents freezing.

6. I would consider this a very poor practice. The exhaust from the pumps is generally used for heating water which is discharged into boilers for steam purposes. Another good practice is to turn the exhaust steam under tanks through the necessary pipes to keep tanks from freezing.

7. I have found it necessary to protect this style of outlet valve and spout with a double box around the spout.

8. I find that the best practice for using float valves is to place the valves within about twelve inches from bottom of tank. This prevents valve from freezing and keeps it in good operation. We use a piece of gas pipe to connect the float valve to the float. The latter is placed at the level where water is required to be kept.

9. Where we can get neither steam nor fire for such protection we put in boxing with two air spaces, both spaces being lined with building paper. This we found to be very effective, and have no trouble.

Arthur Montzheimer, Chief Engineer, and G. F. Powers, Supervisor of Bridges and Buildings and Interlocking, Chicago, Lake Shore and Eastern and Elgin, Joliet and Eastern Railways:

1. I have never found it necessary to heat water in tanks, but when weather is extremely cold and of long duration, I would advocate enclosing entire area under tank with double sheathing and paper, also double windows; tank to have single bottom, so heat from a stove under tank can act directly on bottom, outlet spout and

valve. For a chimney or flue, use a six-inch wrought-iron pipe, fitted to bottom of tank with flange union, turning with an elbow about two feet above the bottom of tank from four to six feet horizontally, and turning with another elbow up through roof to the required height. Use a double floor on top of tank. In addition, I would put a small double casing around discharge or feed pipe so it will not be necessary to use stove except in extreme cold weather.

2. I have never used any means except false bottom and floor to protect bottom and top.

3. I would recommend setting main joist, then laying floor on same two inches smaller in diameter than tank inside of staves. On top of this, set sub joists about four inches high. This allows perfect circulation of air throughout, but rather than this, I would recommend setting outlet valve about eighteen inches above tank bottom. This will allow considerable ice to form in bottom before interfering with valve. Set tub on main joists.

4. I have never used anything to prevent freezing on side of tanks.

5. Providing tanks and standpipes are being furnished from some constant supply, it might be a good idea to connect supply pipe to standpipe connection, but if pipe from tank to standpipe is properly protected by boxing and buried deep enough, I think it would not be necessary. In cases where water is supplied from local pumping station, it would be a rare case where pump would run continuously and unless it does, there will be dead water in supply pipe same as lead from tank to standpipe and as supply pipe is usually a great deal smaller than standpipe, unless it is especially protected, it would freeze the quicker of the two. My experience with water pipes freezing has been generally in or about the pumping station. I prefer pumping direct to tank, the discharge pipe running to top of tub and drain cock placed in pump house, so when pump ceases to work, entire line can be drained. I think this is a very broad question and could be answered in a great many ways, according to location and circumstances.

6. I would not advocate turning steam into suction pipe as it would decrease power of pump.

7. Use long-radius outlet spout and water will not freeze.

8. Use square head steam or cut-out cock size of discharge pipe with about three-foot lever half way between bottom and top of tank, using a pony beer keg or one equally as heavy, so as to stand jam of ice. Same will last for years.

9. We use four thicknesses of dressed and matched sheathing, papered between.

W. M. Noon, Superintendent of Bridges and Buildings, Duluth, South Shore and Atlantic Railway:

1. Use only exhaust steam in suction pipe, and under some conditions, exhaust steam in top of tub to take care of float ice.

2. We use double deck on top of tub, and under roof and ceiling and under floor beams for the bottom. Sometimes a floor on the

floor beams, and under chimes, but I do not like this plan. A frost box with two walls having one-foot space between, all around the four centre posts from below frost line to bottom, with double thickness of flooring with paper.

4. It is advisable to protect from frost, but it spoils tub.

5. Yes, I think it better than anything else, where a man has more than one pump to look after.

7. By boxing and steaming out, either with exhaust or live steam.

8. We place float valve about one half way up in tank, and have no trouble from freezing.

9. Where city water is used, by having float valve shut water off, say two feet from top of tub, and drill an eighth-inch hole between float valve and bottom of tub, to keep water moving. Where pumps are used, by draining pipes and by plenty of air spaces from bottom of tub to below frost line in ground.

C. S. Osgood, Roadmaster, Portland and Rumford Falls Railway:

1. No.

2. No.

3. Cover with sheathing, then with building paper, then three inches of furring and another covering of sheathing.

4. No, never have any trouble.

5. Our tanks supplied by pumps have supply pipe connected to discharge pipe with a cut-out valve between this connection and bottom of tank, so that we can pump directly through standpipe to supply locomotive in case of trouble with tank, or when repairs of same are necessary.

6. No.

7. With loose delivery spout, which is hauled up by counterweights, outlet valve is located near centre of tank. Delivery to outside of frost proofing has an incline of about one and one half inches to two inches to insure quick drainage. Not altogether satisfactory in facing westerly. Swing spouts should incline inward to centre of frost proofing, with large drip opening, and automatic valve to close same when delivery valve is opened, and to open promptly when delivery closes.

8. None in use. We have tanks with gravity supply and let water flow continually.

9. In the cold of northern New England we find it necessary to have three dead-air spaces and in the extreme cold weather when readings are 15 to 49 degrees below zero for extended periods, we find it necessary to have lighted lanterns in frost box.

Tanks that deliver directly to locomotives should be located as far as possible on the westerly side of line, so that cold north winds shall

not strike directly into delivery spout, as such locations are most sure to cause much trouble.

It is the writer's opinion that, if possible to do so, delivery to locomotives should be through standpipes and connection from standpipe to tank should have a cut-out gate. This arrangement keeps the tank away from line, so that it cannot be injured by derailments or otherwise damaged. Furthermore, pipes can be put well underground and standpipe pits are much easier to protect than straight delivery from tank.

A. A. Page, Supervisor Bridges and Buildings, Boston & Maine Railroad Company:

1. No.

2. No.

3. I should double sheathe with paper between.

4. No.

5. No.

6. No.

7. None. Never had any trouble.

8. I place valve at bottom of tank with rod running to float at top.

9. Sheathe inside of four centre posts and double sheathe outside with paper between.

F. L. Park, Master Carpenter, Chicago, Rock Island and Pacific Railway Company:

1. We use nothing of this kind.

2. Nothing else.

3. My opinion is, if climate in which tanks are located requires it, that air space should be formed by roof above tank and bottom of joists which must be ceiled and papered thoroughly and then housed in.

4. No, sir.

5. Always; as it saves double connection to tank, and is cheaper and better.

6. Never have, it not being necessary in this country.

7. We experience but very little trouble along these lines, but as a precaution we equip all our tanks with a steam hose and connection, so if spout should freeze up between trains, hose can be quickly attached to locomotive and thaw what little ice has accumulated.

8. We place valve in discharge line about two feet ab. ve bottom of tank. Section men loosen up from float the ice which may form.

9. I prefer a frost box with two or three air spaces, as location requires. This box to be full size of space enclosed by four centre posts. This protects from frost, bottom of tank where outlet valve is located, and also protects back end of outlet pipe.

J. N. Penwell, Supervisor Bridges and Buildings, Lake Erie and Western Railroad Company:

1. We do not.

2. We do not.

3. In my opinion, the most practicable way to obtain an air space on top and bottom of tanks would be to paper and ceil along the under side of the floor beams under the tank, having all closed securely around the outer edge of tank. There should also be a provision for ventilation between the floor beams during the summer season to prevent rotting of the timber.

Would recommend papering and ceiling top and bottom of joists on top of tank.

4. I have not given this question much thought, as we have little trouble with any of our tanks, except where we pump from rivers, which run very little during the winter.

5. I would advise connecting pipes from pump direct to water tank.

6. We do not. I am looking forward to the next convention with a view of securing a good plan for turning the exhaust into the suction and discharge pipe. If it can be done successfully I think it will overcome a great deal of difficulty with the ice.

7. We use nothing to protect our outlet pipes where water is taken directly from tank, except a box around the pipe forming air space.

8. We simply place our automatic valve on the top end of supply about two feet below the water line. We seldom have trouble from this source.

9. I consider the best scheme for protecting these pipes is by means of frost boxes about four feet square, built with a frame of two by four studding, double ceiled, and papered inside and outside. Where steam is used for power and it is practicable to do so, I would recommend placing a radiator inside this frost box. The box would become so thoroughly heated during the hours when pump was running, that we would have no trouble during the night. We have no radiators of this kind at present except where we are operating water softeners, but we are considering the advisability of placing one or two of these complete.

W. A. Pettis, Supervisor Buildings, New York Central & Hudson River Railroad Company:

1. We do not use any methods to heat water in tanks in order to prevent freezing and do not think it necessary, the water being in motion almost continually, which prevents freezing. We have never had any trouble in this cold climate with water freezing in tanks.

2. We use no air space on either top or bottom of our new tanks. A few years ago it was considered necessary to build tight compartments at top and bottom of tanks and fill these with sawdust or

shavings, but that idea was exploded, and we use no air space and have no trouble whatever with our tanks freezing. It was thought necessary at one time that the space between the roof boards and the top of the water should be made air tight and filled with sawdust. The timbers would rot in time and let sawdust into tank and cause us endless trouble. Since this has been done away with we have had no trouble whatever, although this is a very cold climate.

3. I do not consider that the air space is necessary on top or bottom of the tank. The explanation of No. 2 will answer this question.

4. We have never found it advisable to protect the side of the tank against the action of frost.

5. We have a number of these in use at the present time and have found them satisfactory at water stations where there is not much water used. It is not necessary at those where there is a great amount of water taken daily, as the circulation will be great enough to prevent freezing.

6. We have never turned exhaust into suction pipes; I do not see what could be gained by doing this.

7. We have very few of this style connections on the New York Central, and where we have them we keep a stove or a steam coil or a small steam pipe running to connection which prevents the spouts from freezing.

8. We do not consider it necessary to take any precautions in running any heat to the float. The float is always kept at the top of tank on the standpipe and the lowering of the water prevents ice from forming to any great extent, at least not enough to prevent the working of the float properly. It depends on the make of the valve where it should be placed in the tank. We usually place our valves near the bottom of the tank with rod extending to float.

9. Our system of protecting the pipes between the ground and the bottom of the tank is to have two air spaces made of matched lumber, lined with felt paper, and sides to go at least below the frost line and take extra precautions at the top where it fits around the timbers at the bottom of the tank so that it is perfectly tight. We have no trouble whatever with our pipes freezing in the cold weather.

H. W. Phillips, Supervisor of Bridges and Buildings, New York, New Haven and Hartford R. R. Company:

1. We do not use any heat in any of our tanks.

2. We have discontinued all frost proofing at the top of all our tanks, simply putting on a good shingle roof. At the bottom we cover the floor joists with ⅞-inch matched stock, making an air chamber.

3. Use plenty of good sheathing paper, covered with good, sound, matched stock well fastened.

4. Have never had any trouble with side of tanks.

5. Not as a preventative of frost, but as a matter of economy, when both lines take same direction.

6. Never have done so.

7. The spout direct from tanks are of the hinge type and when not in use free themselves at once. The valve is placed well to the centre of tank, with good pitch outward. When valve is kept tight we have no trouble.

8. Where float valves are used we take water often and arrange the supply to balance the discharge so as to keep the supply working all the time. We place the ball cock or float valve near the centre of tank.

9. We place pipes well below frost and frost proof by means of air chambers made as tight as possible by means of felt paper and matched boards ; two or three air spaces, as the case requires, building around all the pipes a chamber large enough to make necessary repairs and operate valves, etc., and close the entrance with two well-fitting doors. When so arranged we never have any trouble.

C. W. Richey, Master Carpenter, Pennsylvania Railroad Company:

1. We do not use any method of heating water in our tanks to prevent freezing.

2. We rely entirely in air space on top and bottom of tub to protect from weather.

3. I consider that the use of heavy felt deadening paper applied under the flooring and under the lining, the best method to obtain a frost-proof air space at top and bottom of tub.

4. Have never had any occasion to protect side of tank from action of frost.

5. Have never followed this practice, but it appears to me a very good arrangement, if you can keep your regular discharge line from freezing while you are pumping into the feed line to the standpipe.

6. Have never connected an exhaust line from our steam plant to the suction pipe. I have, however, connected it up with a steam pipe coil in the box around the water pipes to protect these pipes from the action of frost.

7. Where we have a steam plant, we use a steam jet on water spouts of this description. At other plants we depend on them for draining by gravity, and our division force to keep them clear of ice.

8. The only precaution we take here is to keep the water in tub in circulation by constantly pumping water into the tub.

9. The method we follow on this Division is to box in the pipes. We use a box about six feet square with the pipes at about the centre. The walls of the box are constructed of 2-inch x 6-inch studding, lined on the inside with a layer of Bond's heavy felt deadening paper, and then covered with flooring. The outside of studding we cover with a layer of heavy felt deadening paper and then side up with ordinary pine siding. In addition to this we wrap the pipes securely with two or three thicknesses of Bond's heavy felt deaden-

ing paper. We have never had these pipes freeze at any of our water stations; although on one or two occasions in the extreme cold weather it was necessary for us to place a coal stove to prevent freezing.

I am sending you herewith a lithograph plan which is supplementary to above answers.

M. Riney, Foreman of Bridges and Buildings, Chicago and Northwestern Railway:

1. No.

2. No.

3. C. & N. W. Ry. standard frost box gives good and safe results, which is described in the 1900 proceedings.

4. No.

5. No experience other than supply to standpipe, which has given no trouble.

6. We have connected into discharge pipe for experience. It did not work.

7. On way freights we furnish hose to thaw out pipe and valve where water is supplied from running streams.

D. Roundeville, Division Engineer, Chicago and Northwestern Railway Company:

1. No method now in use on this division to heat water in tanks to prevent freezing, nor can I learn that any definite plan was ever formulated to accomplish this.

2. No scheme other than air space to protect tanks on top and bottom.

3. On top, flat roof on tub and over this conical roof, inner or flat roof of two thicknesses, dressed and matched fencing with building paper between them; the outer roof proper of ordinary roof boards with layer of building paper and shingles. Think this as good method as any for top air space. On bottom, our tanks are simply skirted around with beaded ceiling to level of lower side of caps. The joists are left open from the bottom, so that at bottom of tank there is, properly speaking, no enclosed air space. It was formerly the custom to sheathe the bottom of tank joists, but this practice was discontinued because it tended to rot the joists.

4. At one time, years ago, an outer sheathing was placed around tank, with an air space between it and staves. Practice was discontinued, it being concluded that expense was not warranted by benefit obtained.

5. In a number of cases the supply from pump connects with discharge between tank and standpipe, but this is done to save piping and not to secure circulation of water. In such case, the standpipes are

located between pump and tank, or the relative position of pump house is such that saving can be made by connecting into tank discharge in place of making an entirely independent supply to tank. The discharge to standpipe being of comparatively large diameter, generally twelve inches, it is found that except in rare instances the circulation secured in course of ordinary consumption is sufficient to keep water from freezing. In unusually severe weather, or where for any reason the service is shut off, the discharge between the tank and standpipe is drained, valve being placed at tank outlet to enable this to be done.

6. We do not now turn exhaust steam into suction pipe. Trials have been made in the past, but it was found that with pump of prevailing type (Smith-Vaile) the flow of water in suction is impeded, to an extent, by introducing exhaust steam, and it was found by experience that as a general proposition the heating of water could be better effected by running live steam into the discharge than by turning the exhaust steam into the suction; this, of course, where boiler capacity is sufficient.

7. Where steam pump is used and it is not too far from the track, steam pipe is run to tank outlet, a piece of hose connected to it to provide flexible end, and tank fixtures and valves thawed out as necessary by such means. Where other power is used, or boiler is at a great distance from tank, a hose is kept at tank with fittings to connect with locomotive boiler and thawing done with steam from locomotives.

8. It happens that in all tanks on this division where float valves are used, supply is had from city, source being artesian wells or considerable lake depths, the water is comparatively warm and there has been no occasion for any special provision for winter operation. As to position of valve operated by float, after trial it has been found best to place this valve about ten feet from tank bottom, with staging dropped from roof of tank to give access, to enable repair of valve without draining tank.

Plug valve in place in tank on discharge pipe. Twenty-inch copper float is used. Have had no trouble. This is used where city water is furnished and tanks located at a long distance from the pump house.

9. Pipe always connected between ground and tank in frost box. No trouble.

An air-space wall from ditch to top of tank foundation where frost box is placed, would be a benefit and absolutely frost proof.

H. Rettinghouse, Division Engineer, Wisconsin Central Railway:

1. We do not use any method to heat water in tanks to prevent freezing. We have never found it necessary to do so, although very often we find from half to one and a half feet of ice around the outside walls and bottom of tanks, and the only trouble arising from the fact, is that valve does not always close, in which case we have to let water out of tank and chop ice out of the way.

2. We do not protect bottom of tanks against action of frost. We used to ceil under the joists, but have abandoned this method, owing

to the fact that such procedure tends to rot the joists prematurely. We do protect the top of the tanks with a double thickness of matched lumber and paper between same. This, of course, in addition to the regular roof is a floor placed next to the top of staves.

3. For reasons explained in No. 2, I am opposed to air spaces or any other method of protecting tank on bottom, and am of the opinion that there is little benefit obtained from placing protection at the place mentioned. I also consider the method of double thickness of lumber with paper between, for protection of top of tank, entirely sufficient.

4. I have never found it advisable to protect side of tank from action of frost.

5. The question is not entirely clear to me, and so far as I understand it, it depends upon local conditions whether or not to connect pipes from bottom in order to deliver into discharge pipe.

6. I have used, in one or two cases, the method of turning the exhaust steam into suction pipe and found it quite profitable regarding the heating of water.

7. I have never, in my experience, taken any precautions to protect the outlet valve and spout from freezing, and do not know of any device which would effectually do so.

8. I have never found any trouble in keeping float and valve operating properly in winter. We always place the valve, which is operated by a float, from eighteen to twenty-four inches above the bottom of tank.

9. The best scheme for protecting pipes between ground and bottom of tank from action of frost, is in my opinion, the air-space frost proofing, consisting of several layers of double thicknesses of matched lumber, with paper between, and air spaces between the layers. I will say, however, that I have never found any frost-proof box which will effectually protect standing water in pipes from freezing, and unless there is more or less circulation of water in the pipe, it will certainly freeze, no matter what frost-proof box is put in, and unless some methods of heating are adopted.

From ground to bottom of tank we place a frost-proofing box, consisting of four courses each of double matched stuff with building paper between the two thicknesses of each course and air spaces of two inches. This is generally effective, although it is our experience that when water is supplied to tank at nearly freezing temperature, where the supply is from shallow ponds or creeks, no ordinary frost proofing is effective, and that in such cases the only way of preventing the freezing of water in supply pipes, particularly of small diameter, such as four inches, is to drain pipe after each pumping, and all of our tank inlets are provided with valves to permit of this, such valve, of course, being placed near the floor of the tank and worked by stem running up to roof.

I do not recall any other data at this time which would have a bearing on this subject. The past winter in this section was a severe one, and but very little trouble was experienced under the methods outlined above in maintaining the operation and preventing freez-

ing. The liability of freezing up, that is, to the extent of putting water stations out of service, appears to be almost entirely in the supply or piping and is overcome by the effective drainage of pipes. Our tanks are sixteen feet high by twenty-four feet in diameter, and it is found that even when water is pumped in at almost freezing temperature, it very rarely freezes in tank enough to put the tank out of service, even though a heavy coating of ice forms on the side. Such freezing as occurs at the bottom and around valve, can generally be handled by introducing steam jet in the manner described above.

G. H. Soles, Superintendent Bridges and Buildings, Pittsburg and Lake Erie R. R. Company:

1. We use no method of heating water in tanks.

2. We have no air space either top or bottom of tanks for frost protection.

3. Think air spaces on top and bottom of water tanks are not of any value to keep water from freezing.

4. I have never found it necessary to protect side and bottom of tanks from action of frost.

5. No.

6. No.

7. We have none of these as we use standpipes on our line. When we did use spouts in extreme cold weather we used a small torch under valve.

8. When float valves are used, valve is placed near centre of tank and float is located halfway between centre and side of tank. Roof and cornice of tank are made as tight as possible to keep out wind and frost. We nave not found it necessary to use any other precaution.

9. We use two layers of floor boards with a layer of tarred felt between boards. The matter of taking care of water tanks in winter depends considerably on the location and amount of water used. In fact the more water used the less liable it is to freeze.

D. C. Zook, Master Carpenter, Pennsylvania Company:

1. No.

2. No.

3. We formerly made an air space on top of tank by using a two by eight-inch rafter, nailing a two-inch strip along both sides on bottom edge and cutting a 7-8 inch false roof between the rafters, using ten-inch stock boards and jointing them together tightly. This in connection with the roof made an air space of five inches. We also have ceiled up the bottom of the joist of the tub frame under the tub, making an air space of fourteen inches. We have abandoned this practice as we found it of doubtful utility.

4. We have never protected the side of our tanks.

5. I think it would not be a good practice to connect the discharge pipe from the pump with the discharge pipe from the tank, on account of the diminished pressure when the standpipe is in use, causing the pump to be accelerated and thereby causing damage to pump. We always try to avoid, as much as possible, tapping the discharge pipe from the pump on this account.

6. We do not use the exhaust steam to heat the water by turning it into the suction pipe.

7. We have no stations where water is delivered directly from tank to locomotive. We always use standpipes.

8. We have a number of stations where we take the supply from the city or private water companies. In such cases we use automatic valves. These valves are always set about eight feet above the bottom and about the centre of tank. We take no precaution, other than this, either with the valve or float and have never had any trouble.

9. We use an air-tight box made by boxing up the four centre posts of our tub frame, ceiling them up with matched lumber, using double thickness both outside and inside of the posts with tarred paper between, making four thicknesses of board and two thicknesses of paper, making the box seven feet two inches inside and nine feet ten inches on the outside, with an air space of twelve inches between the walls. In this space we put all the valves for controlling both the supply and discharge pipes to and from the tanks. We never have any trouble with our pipes protected in this manner.

Summary of Information Received in Answer to Committee's Circular of Inquiry.

Question 1.—Five members reported that it was their practice to heat water in tanks; four do it occasionally, and twenty-nine do not make any attempt to raise the temperature.

Question 2.—Ten members reported that they made no provision for an air space at either top or bottom of tank; five planned for an air space on top of tank, and none on bottom; twenty-three depended on an air space at both top and bottom; one used air space on bottom only, and one housed in tanks completely.

Question 3.—Two members of the Association stated that they made an air space on top of tank by placing one layer of sheathing and paper on both top and bottom of floor joists which rest on top of tank staves; one places one layer of sheathing without paper on top and bottom of same mentioned floor joists; seven lay two thicknesses of sheathing with paper between on top of these joists; six think one layer of sheathing without paper on top of above mentioned floor joists is ample; two prefer only one thickness of sheathing, but add paper in same place, and two sheathe and paper under side of rafters.

For protection on the bottom of tank, two provide two layers of sheathing with paper between on bottom of floor joists under the tank; three advocate one layer of sheathing with paper under the same floor joists; five think one thickness of sheathing without paper is ample, and three state that two layers of sheathing without paper give good results.

QUESTION 4.—One protects side of tank by housing in the whole outfit, as stated above, and remainder of members who sent in answers appear to find it unnecessary to go to the expense of protecting this portion of locomotive water tanks.

QUESTION 5.—Twelve connect pipes from pumps or other source of supply so as to deliver into discharge pipe between tank and standpipe; eight do likewise when conditions are favorable, and eighteen have objections to this scheme.

QUESTION 6.—Three of the members who answered the circular are in favor of turning the exhaust steam from pumps, where steam pumps are used to pump locomotive water, into the suction pipe connected with same pump, and thirty-five offer more or less strenuous objections to this arrangement.

QUESTION 7.—Where no standpipes are used and water is delivered to locomotives through the customary hinged outlet pipe, fourteen members provide no special precautions to protect outlet valve and spout from freezing; eleven furnish pipe or hose through which steam may be furnished from pump house or locomotive, as found convenient; five box the outlet pipe; five provide stoves in boxing under tank to protect same, and one approves of a long radius outlet pipe.

QUESTION 8.—We find that the location of the float valve on tanks, where they are found necessary, varies from ground to top of tank; one member placing it under tank; four on bottom of tank; two think it should be about one foot above the bottom; five give as their choice two feet above the tank floor; one prefers it elevated four feet from floor; nine find that valve works nicely at a point about eight feet from same; one approves of ten feet; two of fourteen feet, and three have found that a float valve on top of tank has given them satisfactory service.

In order to keep float valves operating properly, two members of our Association find that their forces have to watch valves closely, and one of our members suggests balancing supply and delivery so as to keep float valve working constantly; two, evidently where water is not metered, use no float valve and permit the water to overflow.

QUESTION 9.—Members in practically the same latitude differ as much in their opinion of the best protection for pipes under tanks as they do in the location of the float valve. One uses hollow tile boxing; three are not definite but specify several air spaces; eight build their tanks with one air space; seven with two air spaces; nine find that it is advisable to protect piping under tanks with a boxing having three air spaces; three advocate four tight air spaces, and one thinks it pays to provide five of the same.

Four of our associates find it satisfactory, when possible, to run a steam coil on interior of boxing; two save themselves from trouble

by providing stoves; one advocates draining pipes; one finds a covering of two layers of sheathing with paper between is ample; one builds his tanks with piping underneath protected with four layers of boards with paper between; one fills box around pipes with sawdust, and another goes a little further and not only fills in around pipes with sawdust but provides one air space outside of the sawdust box.

The committee calls attention to subject No. VI, in the proceedings of Eleventh Annual Convention of our Association wherein further information may be obtained on water tank protection.

J. P. CANTY, *Chairman.*
J. PARKS.
A. FINDLEY.
F. L. BURRELL.
K. J. C. ZINCK.

DISCUSSION.

Mr. Canty.—I have not anything to say further than what is in the report, but would call the attention of the members to the paper received from Mr. Gutelius of the Canadian Pacific Railway, which describes a rather unique form of tank; something which we do not see in this part of the country; that is, an outfit with tank and supports entirely housed in.

President.—There is not a member in the house but could give us something on this subject. We will probably not hear from you all, but we would like to hear from some of you. We have a very good report, as you well know, those who have seen it, and we would now like to hear from some of you.

Mr. Penwell.—I think I received 200 messages last winter about tanks being frozen up, and there were only a few days during the extreme cold weather but what I had from one to a dozen men out, thawing out water tanks, and I have been trying to figure out in my mind some way of eliminating this expense; have been trying to arrange some sort of a scheme, or plan rather, of providing steam in the frost boxes to keep it warm around the valves and for thawing out goose-necks with steam; I would like to hear what experience the members have had in turning the ex-

haust in the discharge line, or anything of that kind, to warm the water to a certain extent, to prevent freezing.

Mr. Rettinghouse.—In the section of the country in which I am located we have, perhaps, more frost to contend with than where Mr. Penwell comes from. In regard to the trouble of water tanks freezinz up, I would state that I follow the method of providing each tank with steam hose and make it a rule to have one certain train, for instance, the local freight train, at certain periods, systematically thaw out the outlet pipes, which is about the only place where we have trouble; that is, the outlet pipes and tank valves. The steam hose referred to is hung in a convenient place outside of the tank, ready for use. In the spring of the year we collect the steam hose, tag them properly and send them to our division storehouse for use the next season. Now in regard to discharge pipes freezing up, we invariably run our discharge pipe to the top of the tank, so that as soon as the pump ceases to work the discharge pipe is empty; if not, we would have all kinds of truoble, because there is no frost box made that will keep out the frost. I know of one place on the division that I formerly was on, that we pumped water by hydraulic rams. Of course, they would sometimes stop through some defect, and the moment they would stop the pipe would freeze up; so extra precautions were taken at that tank in regard to frost proofing. The section men had orders to stop on every trip when they passed there, taking proper notice whether rams were working all right or not; otherwise there was no trouble that I know of, of any serious character, on account of pipes freezing up.

Mr. Clark.—On my division, in the last three years, I have not had a tank to freeze up. We use the ordinary hollow frost box, with each side constructed of flooring of matched material and between the outside and inner walls we put in two-ply of felt paper and have had no trouble whatever with it freezing up. In very cold weather, as an extra precaution, I have taken a tubular lantern and set it

down inside of the frost box, and with that it is perfectly free from frost. I have used something on the order used by Mr. Rettinghouse; that is, used steam hose. That is easily used, especially in a yard. You can have one yard engine and fit it with a couple of those hose and have it understood by someone that it is a part of his duty to see that the goose-neck or discharge pipe is kept free from frost, as it is only a minute's job to connect, turn the steam on and thaw the discharge pipe out. I also think we should make the repairs necessary, and get everything in as good condition as early as possible, before the frost comes.

Mr. Staten.—I understand some of the members are using a good many iron tanks, iron tubs, and I would like to know from anyone using them if they freeze any worse than wooden tanks?

Mr. Canty.—In answer to Mr. Staten's question, I will say in regard to iron tanks freezing up, that we have quite a number of them on our division and experience no more trouble in that respect than with the ordinary wooden tank. In every other way they are also found as good as, if not superior to, a wooden tank.

Mr. Killam.—In listening to the discussion I have been interested, and was also interested in reading the report on the tank system of the various roads. Now I may say, at the outset, that the tanks do not come under my supervision, but in going over the road, from tank to tank, from station to station, I take a look at every one, and report it if there is anything wrong. The water system on our road is under the mechanical department, which has absolute control of all the water systems of the road, and I do not report to the mechanical department. I report to the maintenance department. But I may say that I am a little surprised on hearing of so many tanks freezing up. Now along our road we have some cold weather, the temperature falling to some considerable extent. I think on the coldest part of our road the temperature gets down to 42 degrees below zero. A little frosty, that is. I don't know how it gets on the

Lake Shore road, where Mr. Reid is, or some of you other gentlemen; but near Halifax, Montreal and some other places it gets down to 25 below; but I never heard of one instance of the freezing up of any of our large 52,000-gallon water tanks. We have one iron tank, I believe, on the road, and that iron tank is built in two sections, so that if anything has to be done with one section, the water does not have to be entirely shut off. Our wooden tanks are all built of four-inch staves, in thickness, and the top is covered with a flat roof first placed over the top of the tank and then a pitch roof over that, with matched lumber; and that covered with galvanized iron and painted, so that we never have much trouble with the frost.

Some of the tanks are gravitation tanks; but our pumping stations, that is, where it is a regular pumping station, the engine is set inside of the tank frame underneath, and there is an iron pipe goes up through the middle of the tank, so that it gives some warmth to it, and in the case of the gravitation tanks, the tank sets on six posts, all enclosed, with a stove in there for the men; that is, the track men go in there to warm themselves. When I sent this description to Mr. Canty I went to our superintendent of the water system, and we went over the matter to get correct information, and I would like to know if Mr. Canty received my report?

Mr. Canty.—I did not receive any report from you, Mr. Killam.

Mr. Killam.—The trouble must be with the mails on your side of the line.

Mr. Rettinghouse.—I believe Mr. Killam is located somewhere near the North Pole, but he is very modest in his description of the temperature in that part of the country. I believe that he stated that it got down to something like 80 degrees below zero last winter, and I would like to ask Mr. Killam where the supply comes from—that is, the water supply; I don't mean the supply of cold; that is, where you procure your water; from wells or from rivers?

Mr. Killam.—In some cases from rivers and in others from wells and reservoirs.

Mr. Rettinghouse.—Is it not a fact that you have experienced more trouble with ice coating from water supplied from creeks and rivers than from the wells?

Mr. Killam.—Mr. President, in answering that question I will state that none ever having frozen that I know of, I cannot tell which is the most difficult.

Mr. Rettinghouse.—That is certainly a most remarkable state of affairs.

Mr. Staten.—I would say that I was called out several times last winter to help thaw out tanks on our road. It is a little like the "Arkansas Traveller"—in the summer time they don't need fixing and in the winter time they can't fix them. If those in charge of the tanks would take more pains during the summer, and would do more in the way of getting ready for the winter, we would have less trouble on account of freezing up.

Mr. Reid.—I do not have charge of the water supply on the Lake Shore, but I see the tanks going back and forth, as Mr. Killam does, but I have never known a tank to freeze up on the Lake Shore. I do not say that they don't freeze up, because if they did freeze I might not hear of it; but I see the tanks in use day after day all winter, apparently without any trouble, and I do not suppose there is much freezing there or I would know of it. I think the matter is largely one of proper design of the tank, of the location of it, and that the proper attention is given them in the fall; that is, seeing that everything is in shape for going into the winter, just the same as any other structures. And in designing water tanks in a particularly exposed location it might be well to house the tank entirely, as a matter of special precaution against the cold. We have a great deal of severe cold weather along Lake Erie, and in Michigan it gets down to 20 below zero; very rarely any lower than that. That will freeze up a water tank if it is not properly protected, and sometimes we get a very severe wind along the lake.

Mr. Killam.—How thick are the walls?

Mr. Reid.—Three inches. We use three-inch spruce or fir; a good deal of it is spruce.

Mr. Killam.—In ours we use four-inch-thick staves; use pine; the very best quality of pine; do not use spruce; it is not as good as pine, in my opinion. And, Mr. President, I will say that if Mr. Rettinghouse will just come down our way, I will be glad to show him our tanks.

President.—Anything further on this subject, gentlemen? If not, we will pass to the next subject, subject number eight. (No report.)

DISCUSSION.

Mr. Schall.—In regard to subject number eight, I am interested in that, and while the committee has not made a report, I would ask whether any of the members have been using any steel sheet piling. I am very much interested in the subject of steel sheet piling in cofferdam work.

President.—Can any member give Mr. Schall any information on that part of the subject brought out by him? Have you had any experience with any kind of metal sheathed piling?

Mr. Soles.—In regard to steel sheet piling. I have had no personal experience in using steel sheet piling. I saw them used by Contractor Sims while building piers for bridge over Shenango River, near Newcastle, Pa., for the P. & L. E. Ry. Co. They seemed to have considerable trouble in removing them after the foundation of pier was completed, especially the first pile. This may have been due to pile being bent in driving or the concrete settling around the bottom end of pile.

Mr. Shelden.—I do not think I can give any information of real value. I understand it was used at Cos Cob and that it gave some trouble, which may have been caused by the kind of soil, which I learned was coarse gravel.

Mr. Steffens.—The cost of steel piling is several times that of the wooden article. It is used to the best advantage in

soft bottoms, rather than in gravel or rocky bottoms. These points will be investigated by the committee.

Mr. H. H. Eggleston.—Our company is putting a bridge in over the river at Chicago, and I have watched the work there very closely. We are using steel sheet piling and it has been very successful.

Mr. Reid.—The steel sheet piling in ordinary bottom, that is, sand or clay, or a bottom free from rock or boulders, is all right, and will, perhaps, drive better than wooden sheet piling, but for general work in the ordinary soil, I think good three-inch oak sheet piling will answer most purposes if properly driven.

President.—If there is nothing further on this subject, will pass to reports of standing committees.

(No report on subject number one.)

DISCUSSION.

Mr. Eggleston (W. O.).—The Erie is now preparing plans, that is, standards for pile and timber trestles, and when I come to the next Convention I expect to be in a position to have the plans with me and be able to talk upon the subject.

President.—The Chicago & Northwestern Railroad gets out several small sheets, one showing their standard 13-foot standard pile bridge, and another 16-foot, and perhaps one other type; these could be put in the proceedings, together with a bill of material for same, and I think it would be well for some of you gentlemen, if you have any such standards, to send them to the committee without waiting to be asked, as the letters often go astray, and the committee will then have no excuse. If the members would do some of these things occasionally, without being asked four or five times, the committee would not be obliged to wait until the last 15 days to try to get out a report; it would be a great benefit to the Association, especially on this one subject.

President.—Is there anything further, gentlemen?

Mr. Reid.—I think it would be well for the members sending in the plans of standard pile bridges to show what engine loading they are designed for, as a plan that would suit one road might not do for another.

Mr. Staten.—Mr. President, on a good many pile trestle on our road we found the plumb posts were all loose from the cap and we shimmed them up by driving shims up good and tight, but it would be but a short time before these became loose again, and it was necessary in one case to double-cap them, but since doing that we have not had any trouble with these posts settling down and leaving the cap.

Mr. Clark.—I very much regret there has been no report made on this subject. The only thing I saw was a letter from the chairman, Mr. Edinger, some time ago, and while I answered his letter, I fully expected there would be some kind of a report made. With us the pile trestle has become, you might say, an obsolete factor in railroading, except for temporary work or on side lines or branches. The object of our company on all the Trunk Lines is to eliminate all wooden structures. Our company has a very good set of standards; I think their specifications take in every length of span from six feet to 16 feet. For our 15-foot spans, the lumber specifications call for four stringers eight by 16 inches, best class long leaf yellow pine. We drive for our standard a four-pile bent. Our cap is 14 by 14. I have found it very satisfactory in territory where we have not got a solid foundation, to double cap. Our bracing is three by 10. We do not use a corble, in fact I think it is a pernicious habit to use a corble on any wooden structure. I do n't think it adds to the strength of the structure at all.

President.—If nothing further on this subject, we will pass to number two.

REPORT ON STEEL BRIDGES.

(Subject No. 2.)

To the Association of Railway Superintendents of Bridges and Buildings:

In preparing its first report your Standing Committee No. 2 on Steel Bridges, has thought best to study the subject from the standpoint of the supervisor of bridges, rather than that of the engineer; and, as a basis for a report, has canvassed the Association on the following subjects:

No. 1. Methods used in erection of the different classes of steel structures, on lines having densities of traffic, giving in each case the cost of work per ton of steel.

No. 2. Methods of riveting.

No. 3. Methods and appliances used in cleaning and preserving steel from corrosion.

No. 4. The experience of the Association in the matter of corrosion of floors, due to dripping from refrigerator cars.

No. 5. Which method of erection do you prefer? By railroad forces, contractor or the builder?

No. 6. What spacing C. to C. for stringers do you prefer on straight track, and do you prefer more than one stringer for each rail?

No. 7. In skew bridges do you deem it advisable to carry the ends of stringers out to finish square with the track?

No. 8. Do you have trouble from breakage of bridge seat stone?

No. 9. What is your opinion of lattice-riveted trusses compared with pin-connected trusses?

No. 10. Would you put elevation in stringers or ties?

From 150 circulars sent out, replies, more or less complete, have been receiveo from 15 members. We are not justified in drawing general conclusions from so few replies, but perhaps the suggestions brought out will lead to fuller discussion in the future.

No. 1. Methods of Erecting Bridges.

For handling material derrick cars are very generally preferred, being used in some cases with extension booms to erect the top chords of the highest trusses. Wrecking cranes are mentioned by several, but these can be used only for setting girders; while properly-equipped derrick cars are applicable to a variety of structures.

Travelers are used for erecting truss spans by some, but derrick cars are replacing travelers wherever available; one writer claiming that trusses are erected as cheaply as girders where the use of travelers can be avoided.

A majority erect girder bridges and sometimes truss spans at one side and slide them into place between trains. Generally trusses

and sometimes girders are erected in place and the floor shifted in between trains. The method adopted depends very largely on traffic conditions. One member builds a temporary track around the site where traffic is very heavy. Gallows frames are mentioned for handling very heavy girders, but not to the extent that they deserve; and for deck-plate girders of moderate spans, riveted up complete, a pile driver is suggested as a convenient tool for handling one end.

The cost is given by only a few correspondents, \$4 to \$20 per ton being the range; girders are quoted at \$4 to \$10, and truss work \$10 to \$20. Transportation of material, tools and men is not included in these prices.

The committee would refer those interested in erection problems to the report and discussion on best form of traveler, p. 70 and following, Proceedings of 1904, and to report on falsework, p. 102, Proceedings of 1903. Local conditions and the exigencies of traffic must govern a discussion of this question, of course, but if the meagre replies received indicate any particular trend it is to the increasing use of derrick cars built expressly for road department work.

No. 2. Method of Riveting.

There is practical unanimity in recommending pneumatic riveters where the work is of sufficient magnitude to warrant it. Only one reply expressed a preference for hand-driven rivets. Small jobs and sometimes large ones, due to lack of a sufficient number of air plants, are driven by hand, so that work ought to be designed in all cases on the basis of hand driving for field work.

In certain tests made by the Committee on Iron and Steel Structures of the American Railway Engineering and Maintenance of Way Association, it appeared that pneumatic hammers upset the rivets in the holes fully as well as the best hydraulic-pressure riveters used by modern bridge shops.

No. 3. Cleaning; and Protecting Steel from Corrosion.

Nearly all the replies report hand cleaning. Four or five have used the sand blast with good results, but it is quite expensive. One has used a strong solution of lye with marked success for cleaning steel for painting. Several parties not using the sand blast express a favorable opinion of it. Those having considerable experience with it, think it practically indispensable where the steel is badly scaled and pitted. When this condition obtains it is not possible to clean iron by hand so but what a coat of paint will be quickly tnrown off.

Where ordinary weather rust occurs it can be kept under control by ordinary cleaning and painting, if in about a year after the work is done, it is gone over and the spots which show rust a second time are touched up. Certain exposed parts of a structure become rusted before others, of course; and if these parts were repainted two or three times to the other parts once, economy would result. Painters, however, dislike to paint by patchwork, and the result is that the exposed parts are allowed to get beyond control before it is decided to paint the structure as a whole.

As to kinds of paint used, no two replies agree. Several are experimenting with hopes of learning something valuable. It is pretty well ascertained that no one kind of paint is the best for all condi-

tions. Asphaltum paints are much better in sheltered places than in the sun. Linseed oil paints are much better in the sun than in dampness. Inert pigments in gum vehicles are better where exposed to engine gases than metallic pigments. An absorbent of moisture is a desideratum for a priming coat. It will be admitted that it is asking much of a film of paint only one one-hundredth of an inch thick, to protect a material so readily oxidizable as our open-hearth oxygen-filled steel, from the corrosive action of engine gases, brine and the weather for a term of years.

It is manifest that the final word has not been written yet on the paint question. The American Society for Testing Materials is doing valuable work investigating the matter. For train-shed roofs the P. R. R. at Jersey City has found it advisable to cover each member of iron work with a thin parafine paper smoothed on to a coat of undried paint, and then to paint two coats over that. It seems to protect the iron perfectly.

No. 4. Corrosion of Floors from Refrigerator-Car Brine.

Over half the replies report no trouble, or but very little on this score, on account of absence of refrigerator cars from their traffic. Several report a good deal of trouble but use no remedy except frequent cleaning and painting. Mr. Loweth of the Chicago, Milwaukee and St. Paul, writes:

> I have lately been covering the tops of stringers and beams with a cotton ducking saturated in a preparation of linoxyn and a resinous flux. This prepared canvas is ironed hot on to the steel surface and adheres more or less perfectly, and I hope to get good results from it; but have not had it in service long enough to say positively. This preparation is called "iron bark," and is manufactured by the Edward Smith Co., New York.

Mr. Cartlidge, C., B. and Q. R. R., writes:

> We find that a concrete deck with ballast is an absolute preventative of trouble, and are employing that wherever possible. On bridges where a concrete deck cannot be used, we are having good success with felt roofing; cutting it into strips slightly wider than the flanges of the stringers and placing it there and underneath the ties, first painting the iron with the compound used with the roofing.

No. 5. Erection by Railroad Forces, Contractors or Builders.

A majority of the replies favor erection by railroad forces. Those representing the larger systems generally erect all bridges with their own men. Very few prefer contractors for all bridges. About one half of the replies favor contractors for large jobs and road forces for girders and small structures.

If a railroad system is large enough to keep a force of men and equipment constantly employed the work can certainly be done more economically by them than by contractors, but if idle times occur, the case will be reversed. Railroads of moderate size must maintain repair gangs for making running repairs on iron bridges and these men, supplemented with carpenter crews, can put in small structures. The independent firms who make a specialty of erecting bridges furnish a means for those roads to contract the erection of large bridges independently of the builders, when the latter wish to eliminate erection from their contracts.

There is no difficulty, as some maintain, in having outside parties erect bridges and care for falsework under traffic. The question then resolves itself into one of economy; and it is evident that where such work can be made continuous, railroad men can do it cheapest, but when but little is done the larger jobs should be contracted.

No. 6. Spacing of Stringers.

The replies to this inquiry vary from 5 to 8 feet, several stating the practice on their road and giving a preference for a narrower spacing. No one desires a wider spacing than their standard. One, whose stringers are spaced 7 feet, 6 inches to 8 feet, 6 inches, prefers 7 feet. Another, with 5 feet to 7 feet spacing, prefers 5 feet. Those using four stringers per rail say nothing against the practice; while several using single stringers per rail, object to the possible unequal distribution of the load where more stringers are used.

Where more than two stringers per track are used, the practice varies; one using four stringers spaced 2 feet, 6 inches on centres, all through, making 7 feet, 6 inch centres of outer lines; another has the inner ones 2 feet, 10 inches, and the outer 6 feet, 10 inches on centres; and another, the inner ones 5 feet, and the outer 10 feet. In the latter case the inner stringers are designed for the full load and the outer ones on a lower assumed basis for safety in case of derailment. The two former cases have stringers of equal section on the assumption that the load is equally distributed between them.

This subject should evidently be studied further by the committee. The practice is so divergent that some one must certainly be wrong. The length of standard tie is one element of the problem. The amount that we feel justified in depending on the wooden tie to act as a beam to help out the iron floor beam is another element; and the amount of overhang outside the stringer, that we can admit is a third.

Mr. Carpenter, Southern Railway, says:

> Our steel viaducts are . . . spaced 7 feet and 10 feet and in one case as much as 11 feet centres. I think 10 feet and 11 feet centres too much, as we do not get the life of the timber in the cross-ties that we do at 7 feet centres.

This phase of our subject deserves much fuller discussion than it it has received, and it is suggested that cross-sections of the arrangement of stringers, ties, guard rails and guard timbers that each member prefers, be collected by next year's committee on this subject. The preference of the members, based on their experience, should be submitted rather than the actual practice on one's road. Attention is called to the report on this subject, finely illustrated, on pages 234 to 239, Proceedings of 1897.

No. 7. Finishing Ends of Stringers Square to Track.

The replies are unanimous in favor of squaring the ends of stringers. This is remarkable, as it is certain that many roads do not follow this excellent practice.

It is pertinent for the committee to extend this inquiry to deck-plate girders, which can be squared as readily as stringers, although it is frequently not done.

Attention is called to the bridge ends illustrated on pages 240 and 241, Proceedings of 1897.

No. 8. Breaking of Bridge Seat Stone.

Six of the fifteen replies report no trouble. The rest report some trouble from breakage of limestone under bearings; especially when they were imperfectly bedded when they were set. Sandstone, granite and concrete give no trouble. One member complains of breakage of stone under stringers, due to the tearing out of anchor bolts by the movement of the bridge from temperature changes. The design must be defective in such cases, for the stringers should be free to move on wall plates.

As to wall plates and concrete for bearings, attention is directed to page 103, Proceedings of 1904.

No. 9. Pin, versus Riveted Trusses.

The question is worded "lattice riveted trusses" in the circular, but riveted trusses of all types are intended to be included. Of thirteen replies to this inquiry four prefer riveted trusses to pin; three prefer pin to riveted; and four prefer riveted to pin up to certain limiting spans, running from 130 to 160 feet.

Two express no preference, but state that a few riveted trusses have recently been put in on their lines and are giving good satisfaction. Some trouble from the wearing of eyebars on pins is reported, and one advocate of pin connections would make the threaded portion of the pins long enough so that a hole for a cotter pin can be bored outside the nuts. One member on a large and up-to-date road states that his practice is growing towards the larger use of riveted connected trusses, and the observations of your committee accord with this view.

This question, outside of the maintenance features of the two types of trusses, is hardly within the perview of this Association. It was threshed over pretty thoroughly by engineers thirty years ago; with the result of concluding that either type, within proper limits of span, was all right if properly designed and built. Pin trusses are cheaply and quickly erected; this consideration led to their almost exclusive adoption in some sections of this country; and, without question, they have been built in the past for spans where riveted work would have been much the best. The tendency, noted above, to build riveted trusses for longer and longer spans shows the recovery from the pin-truss fad.

No. 10. Super-elevation on Curves.

The replies to this question vary widely. Of fifteen replies five are in favor of putting the elevation in the ties, eight prefer putting it in the stringers, and two use raising strips on the stringer or girder under the ties. One tilts spans under 50 feet, and the method of working the elevation into the ties varies.

Like No. 6, this question should be further studied by the committee; and the different practice of various members brought out by illustrations. The point is made that tapered ties are not of equal strength throughout. This argument loses its force if the main stringers are five feet on centres. The arrangement of the iron floor affects this question, and it will be well to study both questions as a unit. No. 7 is closely allied, and the method of passing from the bridge ties to the ground ties may well be included. This covers the form, size, etc., of the parapet or ballast wall.

Our replies are too few to draw very general conclusions from, and a first report cannot be in any way complete, but it is hoped that the foregoing may lead to profitable discussion and show the way to more efficient work in the future.

Respectfully submitted,

H. H. EGGLESTON, Chairman,
J. P. SNOW,
C. H. CARTLIDGE,
H. M. TRIPPE,
J. W. LANTRY.

WRITTEN DISCUSSION ON STEEL BRIDGES.

(Subject No. 2.)

BY R. H. REID OF THE LAKE SHORE AND MICHIGAN SOUTHERN RAILWAY.

1. Method of erection of plate girders on the Lake Shore is usually to put them in place with our large steam derricks, with a cost from $4.00 to $6.00 per ton. Truss bridges are built on false work, and using travelers in the case of large trusses for erecting the upper parts.

2. We use the Cleveland Pneumatic Tool Co.'s pneumatic hammers with a Fairbanks-Morse 12-horse power engine and air compressor, wherever we have a job large enough to warrant it, and on the small jobs, where there are only a few rivets to drive, we use the ordinary hand hammers.

3. We use brushes, hammers and chisels for cleaning off dirt, rust and scale from the metal, and use the best paints that we can make or buy for the protection of the metal, but so far have found nothing that will preserve the metal against salt brine. Our standard paint is composed of red lead, lamp black and linseed oil in the proportion of ten pounds red lead to one pound of lamp black.

4. Our experience in this line has been very bitter, as we handle a great many refrigerator cars, and, on the east bound tracks especially, the corrosion has been very serious, in many cases causing the renewal or reinforcement of floor systems and girder bridges. The question of dripping of salt brine from cars is one of the most important that confronts American railroads, and merits the most vigorous treatment for the prevention of the dripping,

5. We erect all our structures, and very much prefer that method.

6. Our standard spacing for stringers is 6 feet 6 inches center to center, with a single stringer for each rail. Double stringers with pairs centered under the rails will permit the use of lighter ties and perhaps prolong the service of the ties but will require more metal in the stringers, and also in the floor beams, as the center of connection with double stringers centered under the rail gives a longer moment arm for the floor beam.

7. We prefer to make the ends of stringers finished square with the track where it is practicable to do so. This can usually be done unless the skew is more than 45 degrees.

8. We have very little trouble from breakage of bridge seat stone where we have used the Cleveland sandstone, and no trouble at all from breakage with the Cleveland stone where the bearing of the bridge has been properly proportioned. Where we have used the Joliet limestone it has been a source of grief all the way through, and we have had endless trouble with breaking and shattering of this stone, and I consider the Joliet limestone about the poorest thing that was ever put into bridge construction. Our experience with it dates back over a range of fifty years, so that it cannot be considered a temporary opinion.

9. Rivetted lattice trusses up to 180 feet span make excellent structures when properly designed and erected, and are preferred over pin-connected trusses. Above 180 feet span we prefer the pin-connected trusses on account of ease of erection and simplicity of details and connections.

10. If the superelevation of the track is to be more than one inch, and is permanently fixed, I would prefer to put the superelevation in the stringers where it is practicable. If it is less than an inch or the superelevation is changed from time to time by change of line of grade, it may be preferable to put it in the ties rather than go to the extra expense entailed by putting it in the stringers, as it will, of course, cost more in the construction of the bridge to put the superelevation in the stringers than it will to put the stringers in level and symmetrically around the center line. In the case of plate girder bridges we usually place the girders at the same superelevation as the track so as to make the ties frame alike at both ends, and also make the girders take as large a component as possible of the horizontal thrust due to curvature, leaving the lateral and sway bracing to take as little as possible.

WRITTEN DISCUSSION ON SPACING OF STRINGERS IN CONNECTION WITH REPORT ON STEEL BRIDGES.

(Subject No. 2.)

BY J. P. SNOW, BRIDGE ENGINEER BOSTON & MAINE RAILROAD.

I prefer main stringers 5 feet center to center with side stringers 10 feet center to center. Our standard ties are 12 feet long, and any other arrangement of stringers does not give satisfactory support. With this spacing we are enabled to use ties 7 inches deep by 8 inches wide. These are notched to 6½ inches, which is enough to receive the spikes. The legitimate function of a tie is to hold the rail to gauge and line; it ought not to be asked to act as a beam to assist the iron floor of a bridge, which is what it is required to do if the stringers are spaced wider than 5 feet on centers. I admit that it saves in first cost to use a large tie and less iron, because timber is

cheaper than iron wherever it is applicable. By the same token the entire bridge if it is not over, say 150 feet span, can be built cheaper in wood than in metal; but if we are building an iron bridge I think we should make all of its supporting parts of iron and leave the ties to their normal function.

Our side stringers are about one-half the strength of the main stringers so that they will safely carry the trains if off the rails. Their spacing is such that the ties overhang enough at each end to bring the guard timber bolts clear of the iron, but not enough so that the tie can break off or tip up if a wheel is on the end of it.

If the main stringers are spaced more than 5 feet apart, larger ties than those above described are needed; they must act as beams; and, as the maximum bending moment obtains under the rail where the tie is subject to injury by the spikes and cutting by the rails, they must be renewed at shorter intervals than if they act simply to support the rail directly over the stringers.

The side stringers add to the rigidity of the floor and their cost is partly recovered by the smaller size and longer life of the ties.

In the case of deck plate girder bridges, we set the girders 9 feet on centers and put in cross floor beams with stringers 5 feet on centers; the tops of the stringers being flush with the tops of the girders, thereby giving four supports to the ties.

These girders, up to 65 feet long, are shipped to us riveted up complete; and they are more easily put in place than single girders. The additional cost of the floor is not so much as would be thought at first glance, as the floor beams constitute a large part of the bracing. The extra cost of the floor is equal approximately to two suits of ties.

By this construction the top flanges of the girders are relieved from the direct action of the wheel loads and are left to their legitimate function of compression only. Many old plate girders show distress by the top angles working on the web from the pounding of the wheels. It is, in fact, the only way in which I have ever known a plate girder to fail. The above construction remedies this trouble and should, I think, be given more consideration than it has heretofore received.

The significant thing about the report is the complaint of several members of too wide spacing on their lines. Now these complaints are by men who deal with the actual business of caring for bridges, not by engineers theorizing about economy or the elastic advantages of a springy tie; and I think the complaint should be heeded.

Custom and standard practice are tyrannical masters, but our Association fails of all good if we cannot change our practice if shown something better. If there is any sound reason why the supporting stringer should be removed to a distance from under the rail, which it is its only duty to support, and the rapidly decaying wooden tie be called upon to help out the iron floor beam, I should like to have such reason explained to me.

DISCUSSION.

Mr. Reid.—Mr. Chairman, on the question of steel bridges there was one reply sent in too late for incorporation into the report. This gives our ideas on it pretty well, but there may be some questions come up as to why we do these things.

In regard to the first question—method of erection of plate girders—we erect them on the Lake Shore with derricks. We have large derricks and can make the changes very quickly, and in fact a very short time ago we had occasion to take out a 60-foot deck girder and we replaced it with another deck in 18 minutes from the time we actually disconnected the rail until the rail was connected up again, ready for trains, taking out the rail and the old bridge, loading it on cars, bringing in the new one, lowering it into place and getting the rails back in shape for traffic again. As to the riveting, we use a pneumatic riveting outfit, Cleveland Pneumatic Tool Company hammers, With Fairbanks, Morse & Company's gasoline engine and air compressor, on all jobs large enough to warrant installing the air compresser.

We use the old-fashioned "Armstrong" method for cleaning and preserving the steel from corrosion, that is, hammers and chisels. The brushes are all right for ordinary cases, but we have a great deal of scale on our line, due to salt brine, that will not brush off; caused by drippings from refrigerator cars, which forms on the stringers and metal surfaces. It gets very hard and forms on there so that it has to be hammered and frequently cut off with chisels, and even then it is difficult to get it clean, and takes a great deal of hard work. As far as paint goes, I do n't know of anything that will preserve iron against salt brine; have tried all sorts of paints and everything else that we could do, and even put some sheet lead over some of the stringers. Any man who will get up a good protector against salt brine will be heartily received by all bridge men.

In regard to the method of erection, by the railroad forces, contract or builder, in our case we consider it decidedly preferable to erect all our own work and spans of all sizes. We have had only two contract jobs in 15 years. The center spacing for stringers is six feet, six inches, ordinarily, on a tangent, though in case of curves they are sometimes spread out to seven feet, and may be even wider than that.

For bridge seats we have used in the Chicago track elevation work, Joliet limestone, which is about the meanest stuff ever put under a railroad bridge. Limestone is absolutely worthless for bridge masonry. In regard to the riveted lattice truss, will say that we prefer them up to 180 feet in length and the pin-connected trusses beyond that. In regard to putting elevation in the stringers and ties; in all ordinary cases, where the elevation is fixed, I think it preferable to put the elevation in the stringers. In the case of small girders it may be preferable in some cases to use a tapered tie, but in many of the girders on the Lake Shore we have put the elevation right in the girder, the same elevation as in the track. That puts part of the centrifugal thrust of the train directly into the web of the girder.

President.—I would like to hear from some of the other gentlemen on this subject of steel bridges.

Mr. Eggleston (W. O.).—In traveling over our line I often see what the practice is on other lines. I notice the Lackawanna has been doing a large amount of heavy bridge work lately. They handle nearly all their material with wrecking cars. They are now erecting a bridge at South Buffalo over the Erie tracks and they have a large traveler there; and on certain parts of the bridge that they cannot reach and handle successfully, they use the derrick with the traveler, make hitches on the traveler and place the metal in place. On the Erie nearly all material is unloaded with derrick cars and assembled, that is, the heavy parts, and I think the Lehigh Valley is handling a great deal of their bridge work in that way.

Mr. Heflin.—On the Lehigh Valley our truss bridges and long girders are usually erected by the bridge company that furnishes the bridge; they, as a rule, for erecting the truss bridge use the traveler, but for heavy girders they use a gallows frame at each end, or two steam cranes when they can be provided. In putting in small girder bridges with our own force, we usually put up a crib or trestle, bent at each abutment beside the old bridge; on this, with the

steam derrick, we place our new girders, where we assemble and rivet the bridge and complete it with the ties and guard timbers, then taking advantage of time between trains, we tear the old bridge out and slide the new bridge in place, the time consumed being usually from one to one and a half hours.

As to bridge seats breaking, we have had quite a number break, owing to the quality of the stone we have in our section being poor for bridge seats. Last year we adopted the plan of putting in concrete blocks, say 16 inches high, two feet, three inches, to two feet, six inches, long. Of this we made blocks for 25 bridges, then filled between the blocks with concrete. These have been in for a year and they show no sign of chafing or being cut by the bed-plate of the bridge. The reason for making the blocks is to keep from having to trestle each end of the bridge, should we want to raise the bridge or renew the coping, which we often do.

As regards the rust caused by the salt brine from refrigerator cars, it is pretty hard to overcome. We had one bridge that was badly rusted from this cause, especially the floor beams and stringers. We cleaned it off as stated by the brother, with hammer and chisels, then brushed it thoroughly with wire brushes, then gave it two coats of Nobrac paint, or B. P. & S., No. 19. Only about four months has elapsed since this work was done and the parts appear nearly as bad as before. I am of the opinion that nothing short of a-sand is sufficient in cases of this kind to cleanse the metal that is brought in contact with this brine. Once thoroughly cleansed, paint it every year.

President.—Some of the new members here that know something about steel bridge work we would like to hear from you.

Mr. Rettinghouse.—The remark made by Mr. Reid in regard to covering stringers with sheet lead, I believe at one of our former meetings, I think it was at Quebec, the subject was brought up of covering the stringers with roofing preparation. Some of the members will recollect it. I

was wondering if any of us have tried that experiment to protect against the brine from refrigerator cars.

Mr. Reid.—In regard to that, I tried that also on our road, but the wear of the tie and stringer soon cut the paper at the end of the flange and the sand and gravel drifted in there and cut through the paper. The paper was good as long as there was anything left of it, but it won't stand the wear. It would cut out, just about the same as lead. The lead gave out at the edge of the stringers, so that it was not a success.

Mr. Large.—I was figuring a little on this matter, not so much on account of the brine or anything of that kind, as we do not have anything of that nature to contend with on our line, but for protection against fire.

Mr. Perry.—Mr. President, I should like to ask a question here, in regard to the length of the longest span of riveted truss bridges on any of the roads represented here. We had the question come up about a pin-connected truss 200 feet long and now I would like to know if there are any riveted truss bridges that length, and, if so, how are they acting?

Mr. Reid.—We have one 180 feet on the Lake Shore.

Mr. Large.—The Pennsylvania recently erected one 200 feet.

Mr. Killam.—I may say that on the Intercolonial Railway we have a bridge with spans 205 feet long, all riveted connections. They were built some two years ago, and so far as I can ascertain are perfect up to the present time. Last year we put up five spans of 213 feet each and they are all riveted connections, and a short time ago I went over that bridge after it had been painted and I found everything was perfect up to this time. Now we have six or seven spans in one bridge across the Grand Narrows, 245-foot spans, all pin connection, and they are all right so far as can be seen. But yet it is a much lighter bridge than is the 213-feet-over-all span, so that we are really adopting all riveted connections with our bridges, that is, for

all new bridges being put up. We have also one bridge built that was built five years ago with spans 176 feet long, riveted connections, and it is perfect up to the present time; no flaws nor signs of anything giving away, or anything being wrong; no rivets loose nor anything wrong with this bridge; very heavy span, all riveted connections and they are all working just as well as the Grand Narrows and the Great Victoria bridge, double track with public road or street car tracks on both outsides. This bridge has pin connections. The center span is 330 feet, which is the longest; the others are 250 feet, all pin connections, and they are all proving a success and are satisfactory so far as I have learned, so my conclusion is that the fault comes in either case from want of proper work in construction. If a bridge is constructed right and well proportioned, it will be all right.

Mr. Perry.—Is it not your experience that riveted connections are more rigid than pin connected? They appear to be more rigid in running over them than the pin-connected spans.

Mr. Killam.—I do n't know if there is any difference. We have one span over the Restigouche River that is 215 feet long, all riveted and but little deflection under the heaviest engines that pass over it, and with but little vibration. All our bridges are of that nature since doubling up and putting on new spans.

Mr. Reid.—I do n't think there is any question about the stability of a good riveted truss up to any reasonable length. I think the question is one that is readily determined, where to cut out riveted trusses and put in pin connected. Possibly 180 feet to 200 feet is about the limit we should go on a riveted truss; while we may be able to build them longer than that, I think they would cost more, on account of erection, over 200 feet in length, than pin-connected trusses. At that length, with modern loads, a pin-connected bridge is heavy enough to hold itself steady.

Mr. Mountain.—Mr. President, I am a new member of

the society, but I would like to say that I know of a draw span on the Canadian Atlantic 355 feet long. This is a riveted truss across the St. Lawrence River at Couteau. All the spans in that are riveted truss, I think; some are 240 feet long, some 217 feet long, but the draw span over the channel is 356 feet.

Mr. Sheldon.—I would like to ask the member, in his experience, the longest of field rivets which it is practicable to drive.

Mr. Reid.—Mr. President, I would state that we have driven field rivets with five-inch grip and ⅞-inch in diameter. I think five inches grip, or six inches, for a field rivet one inch in diameter is about the limit. I do n't think it is good practice to go beyond that. You can drive cold rivets up to two or two and a half inches in diameter, 10 inches long, but you have got to have powerful machinery for doing it. We drive a good many rivets with pneumatic hammers and, of course, a good many by hand. The pneumatic hammer, if properly handled, will do better work than can be done by hand; and no doubt very much quicker.

Mr. Hudson.—My experience is that the pneumatic hammer is much the best on short rivets from the fact that you can get in many places where you can not get with the hand hammer, but for long rivets I do not believe you can successfully drive them with a pneumatic hammer; at least, that was our experience with contract work. They were unable to get tight rivets when they had chilled the ends.

Mr. Reid.—What sized hammer?

Mr. Hudson.—Sixteen pounds.

Mr. Jutton.—I have watched the two kinds of riveting a great deal, and I think the only advantage, or the greatest advantage, of the air hammer is for driving in tight places where you cannot get at the work with a maul. Now as far as the cost is concerned, I think there is but a very little difference; if anything, I think it is in favor of driving rivets by hand rather than by air. There is no question at all that you can hit a harder blow with a maul, and if the rivets are good and the men are what they ought to be, there

is no reason why you should not get good rivets when driven by hand.

Mr. Hudson.—One more objection to that air hammer is there are places where you cannot get the rivets up tight; you cannot do it with an air hammer.

Mr. Reid.—I am of the opinion that a pneumatic hammer is all right for any place you can work it.

President.—Any other phase of this subject to be discussed? If not, we will pass to number three.

(No report on numbers three, four, five and six.)

DISCUSSION.

Mr. Reid.—In regard to fire protection for bridges, there is one method that has been used in the past, that is, of covering the stringers with zinc or sheet iron. I think sheet iron of about eighteen gauge makes a pretty good fire protection while it lasts. There is one thing, however, you cannot see the top of the stringer, making it difficult for inspection, and also it does not provide much ventilation for the stringer, to dry it out. Of course, it do n't get so much water on the stringer as if it was uncovered.

Mr. Rettinghouse.—My experience is, in regard to the protection of bridges and buildings, that it is not so much the means of putting out the fire, as the way and means of preventing it. One of the principle things to look after is keeping the buildings scrupulously clean in every respect and making frequent, thorough inspection and keeping eternally after the person who has charge of the building. There is a habit of certain railroads of keeping their oil supply and lamp-cleaning apparatus in freight houses or in freight rooms of combination depots, but of late the tendency has been to have those things away from the buildings and to erect special buildings for that purpose, which is a very good move. The most of the fires can be traced to that defect of not keeping the buildings clean, especially in regard to the oil and the taking care of the oil. The same

thing may occur on bridges. We always make it a point to get after the persons who have charge of keeping the surroundings of the bridges clean. In my personal case, I have charge of the entire maintenance and I tell the section foreman direct, or the roadmaster, to keep after the cleaning of the surroundings of the bridges, especially as tó taking away dry grass, rubbish of all kinds and cleaning off the caps and stringers of the accumulations of waste which will very often be scattered, and I can say that we have had very good success in eliminating fires.

Mr. Cummin.—It seems to me the means depends on the men or the man who has charge of the building. We have established a rule on our line of providing the small local stations with fire pails located on the shelves, labeled "For fire purposes only." But on one occasion our inspector came to one station, found the pails even full of cóal and upon taking the matter up with the agent, the agent said he did n't want to have to go to the coal bin so often. In large freight houses and such as that, we provide lines of hose, connected with valves so that all they have to do is to open the valve and it is ready for use.

At small freight houses we have water barrels, with two pails at each barrel, and on trestles we have half barrels filled with water and in the winter time have to watch them carefully in order to keep the water so it can be used in case of fire. It is salt water, but we have to add more salt to it. On the Jamaica Bay trestle, which is four miles long, this last summer, we installed a third rail system and the question came up at once, a fellow do n't want to turn a hose on that. Since installing the third rail system on this trestle we have had 100 boxes made that would hold about half a yard of sand each, water tight, with a cover on them, filled with dry sand and a pail in the center, also filled with sand, so that if a fire occurs this pail of sand in the center of this box is all ready to throw on the fire. We also recently established what you might term a fire protection force. One of the retired chiefs of the Brooklyn

fire department, retired on pension almost in the prime of his life, has charge of that force, and he is going around the terminal stations drilling the men, not only the day men who work there, but also the night men, so as to get them thoroughly drilled in the use of the fire apparatus. A fire apparatus of any description is all right as long as the men know how to use it, but if you have it and the men don't know how to use it, it is money thrown away.

Mr. Clark.—We have something similar to what Mr. Cummin speaks of; in each of our depots we have water barrels standing in the waiting-room and freight houses and pails, supposed to be on a shelf, filled with water. In freight houses of any size where we have water connection, we have hose, and at shops we have lines of hose, etc., and there is a regular drill once every week. The men are called out the same as for a fire and they go through the evolutions the same as at an actual fire. On our wooden trestles we have water barrels filled with water, and it is the section man's job to keep salt in the water and keep in shape in the winter time so as to be readily used.

Mr. Cummin.—I forgot to mention one thing, Mr. Chairman, in the case of any station of importance we do not depend entirely on the water pails, but we have fire extinguishers outside of the regular fire apparatus, and our experience has been that the quicker you get at a fire the better. I think the statistics will show that more fires have been put out by fire extinguishers than by steam fire engines, for the same reason that you can get at it quicker; but as I said in the first place, it depends a great deal upon the men in charge. You will find if you should travel round with an insurance inspector, some very peculiar instances. I heard of one case where an agent had six water pails and for two years when the inspector went there he found them empty and the last time the agent said, "You will never catch me that way again; those pails will be filled." The following year he went around there and the agent saw the inspector and he came out and said, "I am all ready for

you this time.'' He looked at them and they were filled sure enough. The pails were full of water, but they were securely fastened with a chain and padlock, and the inspector asked him for the key and the agent could not find it and went out and called in his assistant. He said, "Jim, where is the key of this lock?" Jim hunted around about twenty minutes, but could n't find the key. Now that is fire protection in a railroad station. There was another place in a signal tower. He went upstairs in the tower and looked around and the inspector said to the operator, "Have you fire protection here?" The operator replied, "Oh, yes, I am all fixed for that. There is a ladder right outside that window; they can't fool me on the stairs." There was another case at some shops where they had water barrels, and the same case occurred there. He found the barrels empty. The party in charge said the hostlers used the water. He told him it was his business to keep the barrels filled and he said, "I will have them filled for you next year." The next year the inspector went round and every barrel was filled and he asked him what method he had adopted. "Oh," he said, "I fooled them this time; I filled them up to within six inches of the top with water and then put in kerosene oil and they got on to it and would not touch it." So I want to know what you are going to do about fire protection.

Mr. Killam.—I may say that fire protection is quite an important subject. I have listened to Mr. Cummin as to the various methods to comply with it, or rather to get clear of carrying out the instructions. I may say, along the line, the bridges, if they are two or three or four spans in length, we have casks which are kept filled with water and the section men are required to keep them filled and any time they are found not filled they are reported and they are fined one dollar apiece.

Mr. Canty.—It occurs to me that considerable trouble may be avoided by protecting floors under stoves. On our road the insurance people get after us sharply if we do not

provide metal, brick or concrete lining under all heaters. We were very much surprised lately on my division when floors in many of our buildings were found unprotected. Such defects will accumulate unless special attention is paid to the matter. Without protection of this sort there is always danger of fire. Practically all the fires which we have had lately in small buildings were caused by defective setting of heaters. The insurance people also watch very closely on our road in regard to keeping record rooms of freight offices clean. Sometimes we find that tissue copies of way-bills are thrown on the floors in a disorderly manner. This may be prevented by providing sufficient pigeonholes and shelves for records.

Mr. Pickering.—I have not listened to the discussion, owing to other business, but I might say that we have a great many shingle roofs on the section of the road I am in charge of, where we have whitewashed the roof as a protection against fire, and, in fact, the insurance people have required several buildings within the last year whitewashed. This is quite a good protection and is also a good thing for the shingles. It preserves them as well as protects them against fire.

Mr. Clark.—There is one little point in the matter of fire protection around stations and that is the accumulation of old records. With most companies they require the keeping of records of stations for seven years. You take a station that does, say from $100 to $150 business a month and the accumulation of old records for seven years amounts to quite a lot of paper. On an inspection tour some years ago I happened to go in the upper story of a freight department building, which was quite a large one, and that entire upper story, clear to the roof, was filled full of tissue copies of way-bills. I do not think there was less than one or two carloads of stuff in that upper story. I think it would be a good protection if the record room was made separate from the station, where records could be kept more neatly and more convenient, and a great deal safer in case of fire.

As to the subject of fire extinguishers, our people issued

an order a few days ago that all extinguishers had to be recharged every six months and with a notice to send them in after six months to headquarters and have them recharged and sent out again. That is necessary, I think, in order to keep the hand fire extinguishers in good shape. I do n't think after they run a certain length of time that the ordinary mixture amounts to anything in case of a fire.

Mr. Cummin.—With us, in regard to fire extinguishers, every time they are recharged there is a tag put on, with the date, so you can always tell when last filled.

President.—We will now pass this subject on account of the lateness of the hour and take up some of the others.

(No report on subject number seven.)

PRESERVATIVES FOR WOOD AND METAL.

(Subject No. 8.)

REPORT OF COMMITTEE.

WEST OAKLAND, CAL., August 17, 1905.

To the Association of Railway Superintendents of Bridges and Buildings:

We, the Committee on Preservatives for Wood and Metal, beg to submit the following:

As chairman of the committee, I will state that outside of the liberal assistance from Mr. J. F. Parker of the A. T. & S. F. Ry. of San Bernardino, Cal., there have been no contributions. I was very much in hopes the committee would take hold of this most important question and give us the benefit of their experience. Personally, my experience has been confined wholly to the treatment of timber. Therefore I am not able to give much of interest as to the outcome of the material after being placed in the structure. I had depended largely on the other members giving me their information; but, as it failed to materialize, I will confine my remarks, which are brief, to the treatment of timber alone.

The subject of wood preservation is one that requires a great deal of discussion and study to be thoroughly understood; even then complexing questions keep arising continually. Conditions vary so in different locations that one form of treatment that is successful in some certain place would be an utter failure in others. There is a too common error of trying to make one standard form of treatment cover all conditions.

It has been carried on in this country upward of thirty years, and quite extensively in the last ten years. The demand for good chemically treated structural timber is increasing as the forest supply decreases and prices advance.

Numerous processes have been tried, some having been successful under certain conditions, others utter failures; some, perhaps, would have been more successful had they been properly applied by some one conversant with the principles of wood preservation, knowing the character and construction of wood. Too many have an idea that to preserve wood a certain routine of work has to be complied with and stop at that,—such as placing a charge in a cylinder, steaming it for a given length of time, running a vacuum up to so many inches for another given length of time, to then apply the preservative fluid and pump into the charge under pressure a given amount. When this is completed the charge is taken out and another one run in and treated in exactly the same manner. No attention is paid to the condition of the material either before or after treatment. The required routine has been fulfilled and that is all that is necessary.

A great many railway concerns and others also submit specifications to contractors to furnish a treated material and outline a routine of treatment to be carried out, never taking into consideration the character and condition of the wood before treatment, but are

always careful to wind up the last clause in the specification reading about this way: "Any piles or timbers broken or injured while being treated by careless handling, or checked by overheating, will be rejected and the contractors must substitute new ones therefor or the original cost of such broken or injured piles or timbers will be deducted from the amount due him on the contract."

The specifications are submitted and an inspector placed on a treating plant to see that they are complied with. In fact, the whole work is done under his guidance and instruction and when material comes out ruined the contractor has to stand the loss.

Wood preservation, to be thoroughly successful, must be looked at from a more scientific standpoint in the future than in the past. It must be something more than a mere mechanical operation.

Climatic and soil conditions and characters of the woods for treatment will have to be carefully studied, and all the surrounding conditions governing the life of wood in the localities in which it is to be placed taken into consideration in order that a treatment may be applied to suit such conditions.

Of all the different processes used in this country the most universally used is the dead oil of coal tar or creosoting process and the zinc chloride or burnettizing process, the latter being used almost exclusively for the preservation of ties. The creosoting process is coming into almost universal use for the treatment of piling and timber for salt water work, as a prevention against marine insects, which are very active, especially in southern countries. It is also being used to a large extent on all pile and timber trestles as a preservative against decay. To a large extent it has been successful, but not as much as it should have been, owing to the fact that lots of the work was done in a careless manner and possibly with a creosote oil that did not contain the proper ingredients for the prevention of decay or the attack of marine insects.

Different ways of applying the creosoting process have been tried, and the one most in use at the present time is that of first steaming the timber with live steam to liquify all resinous matter and evaporate the sap and moisture contained. A vacuum pump is then applied and vacuum being carried for a given length of time, maintaining heat in the cylinder by means of superheated steam circulating through heating pipes distributed throughout the sides and bottom of cylinders; to them apply the creosote oil under pressure. In treating the softer pines, such as Loblolly, short-leafed and long-leafed yellow pine, this process is fairly successful on account of the timber being open grained and easy of access for penetration of heat; also on account of there being a great deal of elasticity in the character of wood, allowing of considerable shrinking during the seasoning process without badly checking or splitting of the timber. With the more firm and closer-grained woods, such as Oregon pine, red fir, etc., especially when the piles and timber are of large dimensions, the steaming and the vacuum process is a complete failure, on account of the heat having to be carried to such an extent in order to reach the center of the timber so it can be thoroughly sterilized. The outcome of this treatment is that the timber is charred to such an extent in order to get it dry, or that there was not enough elasticity in the wood to permit the shrinkage, thereby splitting and checking the wood to such an extent that it is useless for being placed in any structure.

It has been found that these firmer woods can be treated successfully by using a process similar to Boulton's method; that is, of

boiling the timber in oil, thus using the oil as a medium for conveying the heat to the timber, instead of applying it direct as when live steam is used.

The process varies from the Boulton method by eliminating the use of a vacuum pump for drawing off the vapor, as it comes off of its own accord, discharging into a surface condenser through which cold water is circulating, thus creating its own vacuum. The vapor after becoming condensed is deposited in a hot well, and by having a gauge glass attached close attention can be kept of moisture being extracted from the charge under treatment in order to determine the dryness thereof.

Treating in this manner is applicable to all classes of timber, both close and open grained. It takes no longer than the steaming and vacuum process and there is no liability of affecting the tensil strength of the material as the desired result can be obtained with very low temperature, not running over 220 degrees Fahr., when with the steaming process, to get the same result, the temperature would have to be carried to 280 or 300 degrees Fahr., which is detrimental to the wood fiber.

Following is the report from Mr. J. F. Parker, general foreman, B. & B. Dept., Los Angeles Div., A. T. & S. F. Ry. Co.:

As a member of the Committee on Preservatives for Wood and Metal, I beg to submit the following, which is the best information I can furnish, and I hope it will help you in making your report to our Association:

I have been with the Santa Fe Railroad for the past twenty-three years in Southern California, and all the experience I have had with preservatives for wood and metal has been here. Formerly we used redwood where wood came in contact with the ground, but of late years, on account of redwood becoming scarce, of poor quality, and of high prices, Oregon pine has taken its place, which is short lived without the application of some preservative.

We have used creosoted piling in both bridge and wharf construction with good results. In Santa Fe wharf at San Diego we have some Oregon pine creosoted piles still in service which were driven in 1887. There the limnoria is very destructive, while the torredo gives us very little trouble. We have tried several methods and expended considerable experimenting on pile protections for wharves without success, and we are now encasing them in a cement mortar jacket 2 and 2½ inches thick from the mud up to high water line. This is expensive, costing $1.10 per lineal foot, but it does the business. We use Gillingham cement, one part, and fine sand, two parts, mixed with salt water. It is handled by divers, using sheet iron casings about three feet long, and when one is filled another is placed above it, building up in this way to the desired height, the mortar being lowered in buckets to the divers.

In about six days the cement is set enough to allow the cases to be taken off. As a preservative for piling and timber in bridges, of course creosoting is the real thing. We have some piles with this treating which have already outlasted two sets of untreated piles. We have also found that salt is an excellent preservative for piles and timber when placed in contact with the ground, by using old material from the wharf at San Diego, which had been soaked in salt water for a number of years. The water in the bay is very salt, as there are no running rivers emptying into it.

Of late years we have extensively used crude oil in bridge repair leork, on framed bents and decks, also on wooden spans, with excel-wnt results. The oil being applied heavily with brushes it adds very little to the labor cost, as the oil is cheap and is slapped on by the cheapest men in a gang. It penetrates the wood and prevents rotting and checking.

At one time we used coal tar, but found it was not a success, as it formed an outside coat, closed the pores of the wood and caused dry rot inside.

Our experience here with preservatives for metal has not been very extensive. We commenced the erection of steel bridges here in 1896 and used a paint composed of crude oil and asphaltum heated together. This was not a success and afterwards cost more to remove it than the original work. This composition chills very quickly, and in the early morning and in the latter part of the day the workmen would get it on too thick, and in the middle of the day when the metal and weather was warm they would get it on too thin. We also painted steel tanks with this preparation. In hot weather it becomes soft and runs down to angles and shelves on bridges, gets filled with dust and dirt and forms a substance to hold moisture and rust the steel.

On all our structures where this was we have cleaned it off quite thoroughly and applied "Silica Aluminum Paint" (a locally manufactured paint made from volcanic rock and boiled linseed oil), and common "Brown Mineral" paint with fairly good results.

In 1897 we painted a large oil storage tank with the latter, two coats, using an air spraying nozzle. This tank is at Los Angeles and it is in good condition today.

Three years ago we painted a 38,000-barrel oil storage tank with red lead paint; this is wearing splendidly. We have never used any of the patent paints which are so extensively advertised.

Respectfully submitted,

F. D. BEAL,
Chairman.
J. F. PARKER,
Member of Committee.

WRITTEN DISCUSSION ON PRESERVATIVES FOR WOOD AND METAL.

(Subject No. 8.)

BY J. P. SNOW, BRIDGE ENGINEER BOSTON & MAINE RAILROAD.

There is much that may be said on this subject. The price of lumber is increasing so fast that the matter of prolonging the life of timber in structures will soon force itself upon the attention of railroad managers.

It is expecting a great deal of a preservative to indefinitely preserve timber that is unprotected from weather conditions. Nature provides for the decay and decomposition of timber when its circulation of sap is stopped. It is a difficult proposition to entirely counteract nature's laws; but their operation can be retarded and the life of timber prolonged by careful attention.

The ordinary wet and dry rot in timber is caused by the growth in the wood of a mycelium fungus. Its growth is not very unlike cancer in the human system. Its seeds or spores penetrate timber as soon as it is sawed and possibly while the trees are growing. They remain dormant if the timber is perfectly dry or if it is immersed in water or kept frozen. Warmth and moisture promote its growth. The action of the common preservatives is to poison the wood so that the spores do not germinate. To sterilize the timber and impregnate it so as to insure it for a long term of years against decay, is expensive; and it is doubtful if it pays under the present system of railroad maintenance, where radical changes occur every few years, which demand the renewal of structures from other causes than decay.

It seems to me that good judgment in the selection of timber and the partial protection of that most exposed, with a view to prolonging the natural life of the structure, say for one and one half the usual period, is likely to produce more beneficial results than the advocacy of costly preserving methods.

To begin with ties: In every lot there will be those which are not so good as the best, but too good to reject. These, including the sappy and open-grained ones, should be sorted out and used on the short bridges, or, if only one long bridge is being retied, should be put together at one end of the bridge, with the idea of their not lasting so long as the rest. A similar selection of trestle stringer timbers will result in prolonged life of the part made of better timber. We all know of the renewal of the whole of many structures on account of a few decayed sticks.

It is well known that timbers in a vertical position will last much longer than horizontal ones. On this account the posts of framed trestles will last much longer than the caps. If we cover the caps with zinc their life will be prolonged to match the posts. Horizontal timbers suffer much from sun checks, which serve as inlets for water, to feed the growth of the mycelium fungus. If the tops of such timbers are mopped with a penetrating, non-drying oil it will prevent much of this checking; and, if this oil is at the same time antiseptic and non-volatile it will do much to retard decay.

A wash that can be mopped onto timber after it is framed, that will do some good, is a great desideratum. It can be used with little cost and will be approved and allowed by the railroad management when more costly treating will not. Many such washes are advertised, but they are useless unless used with good judgment. Creosotes eat out iron and are wasted rapidly in the sun. Salts of many kinds are dissolvable in water and hence will be washed out by the rain. A solution of paraffin has been used to a considerable extent by the Boston & Maine road and the City of Boston on bridge planking which is covered with sand and paved. This has been removed in perfectly sound condition after 20 years' service. It, however, is not recommended for exposed timber, as the sun and rain destroy its efficiency. An emulsion of paraffin or other antiseptic oil that will spread easily, penetrate well, and neither dry up, wash out nor form a coating on the timber, is greatly to be desired.

It is to be hoped that the members will put their experience on record through the medium of our standing committee on this subject, so that something of value may be learned.

(No report on subject number nine.)

RECORDS AND ACCOUNTS.

(Subject No. 10.)

REPORT OF COMMITTEE.

ENID, OKLA., October 14, 1905.

To the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: We, the Committee on Records and Accounts, beg to submit the following:

As chairman of the committee, I will state that outside of the liberal assistance from two of my colleagues, there has been no contribution of data on this subject. There has been a great deal said on this subject at former meetings of the Association and it leaves very little for your committee to say. The scope of records and accounts is rather broad and, on the presumption that it would really be as far as the Association wishes to go into the subject at one time, we, the committee, submit our views on proper accounting, which means the best manner of bookkeeping without having to deal with speculative profits or losses or variation of values, and this in a way that the receipts by the department in certain values as debits against it may, at all times, balance with the distribution of such values as credits to it.

With the additional accounting of stock of material on hand, this latter either by stockbook or inventory, we find from general observation that there are hardly any two roads that keep these accounts just the same. We think that in many cases there is entirely too much bookkeeping placed on the foreman that takes too much of his time from his other duties. Important to be noted, is that forms should be as few and as simple as possible. Whatever system is adopted, it should be strictly adhered to, not only by the foreman, but by the office force as well.

Do not allow your office to establish any arbitrary rules for the foreman without your approval, and do not approve them until you have satisfied yourself that they are necessary. Whatever office force is maintained, it is of great importance for the proper accounting that the chief clerk has some practical idea or knowledge of material and construction. Educate your foreman to neat and proper accounting and reporting. Insist on all forms being used for the transaction of the business for which they were intended, eschewing all reports on odds and ends of slips of paper or letter heads.

For successful accounting, it would be well not to readjust material prices too often, this referring to stock material; prices should be arranged to be good in accounting for one year, and be readjusted at time of taking annual inventory, for the same reason; all serviceable second-hand material, if to be considered at a valuation, should be carried in accounting as simple as pos-

sible, crediting structure from which it is taken, in the aggregate at one fixed price for each class of material and charged out again in the same manner and at same rate. For example: Not so many prices, but feet in board measure, or so many pounds of cast, or so many pounds of wrought iron.

In conclusion, I will say as chairman of this committee, that I have not had the time to devote to this report that I would like to have had, on account of my work taking up all of my time. Our replies are too few to draw any general conclusions from, and a first report cannot be in any way complete, but it is hoped that the foregoing may lead to profitable discussions and the way to more efficient work in the future.

Respectfully submitted,

H. M. HENSON, *Chairman.*
R. C. SATTLEY,
ED GAGNON,
E. R. FLOREN.

SPOONER, WIS., September 26, 1905.

MR. J. N. PENNELL,
Supt. B. & B., L. E. & W. Ry., Tipton, Ind.

Dear Sir: In answer to inquiries as to best method in repairing roof of any kind, will say:

First—On my district we have a large amount of gravel roofs on a number of engine houses where those roofs have been laid with 4-ply tar felt and the best of material and work done in season before frost has set in. Those roofs have given us very little trouble and where the gravel has commenced to show bareness the loose gravel should be cleaned off thoroughly and pitch and clean gravel put back. If those defective spots are not taken in time they will show up leaky and the elements will cut the paper so it has to be renewed. Therefore, I would recommend frequent inspection and patching for those kinds of roof.

Repair slate roof by removing the broken slates and use a slate ripper to cut the nails, which should be copper; then we use copper or galvanized strips and nail on the sheathing, allowing a projection of ¾-inch below the bottom of the slate, and when new slate has been put in place, bend bottom up over the slate so strips hold the slate in place.

Tin roof; we have one on an elevator that has been on since 1886 and if we give it a good coat of paint every three (3) years it will not give us any trouble. If it plays out, the only way is to put on a patch, as we generally call the old way.

I have on my district quite a few roofs laid with Lap Seal Improved Asbestos. None of them are over five years old and have so far showed no leaks. Those roofs have to be coated every three (3) years, as I think that is the only way to preserve the life of this kind of roof.

Yours respectfully,

G. LARSON,

Superintendent Bridges and Buildings, Minneapolis & Omaha Railway Co.

DISCUSSION.

Mr. Reid.—Along the line of records and accounts, on the Lake Shore we have what we call bridge inspection books, containing a record of the bridges and made up in the form of little handbooks, pocket size, convenient for making notes while right on the spot. In going over the work the inspector makes his notes in the book and then either myself or my assistant takes the books and makes up work orders from them, and wherever it is necessary to secure a special authority to do the work, as in the case of some renewals and things of that kind, we make up such lists and turn them in and after they have been approved, make up the working orders. Then in addition to this record we have plans, detailed plans and working drawings of all iron bridges, as we get all those at the time the bridges are built, so that with our plans of the iron bridges and our bridge record books, which show the physical condition of the bridges, as well as the changes made since putting them in, relative to stringers, renewal of the caps, ties, etc., and other changes, we have a very complete record of our bridges. We also have a record of the culverts as to their size, length, etc.

President.—I think that if the committee should decide to continue this subject next year they will find a great deal of interest can be brought out. The Maintenance of Way Association have been working on it for some time and we might profit by looking over some of their reports. I wish to say in a general way that if our members will avail themselves of the opportunity of looking over the proceedings of the Maintenance of Way Association, they will find quite a number of topics in the same line as our work, from which a great deal of good may be obtained. Anything further on this subject—the last one for discussion?

Mr. Killam.—On our road, the Intercolonial Railway, we have 14 divisions or sections, I have a book—it is about 100 or 120 pages, about five by nine inches, and I start in at one end of the line and go to the other end, always east-

ward. In the book is marked the dates when I am at each structure; I take each one as I come to it and note what I find as to what condition it is in, etc. I have written down in that book before I start, on the different pages, just what structure I am coming to, what kind it is, whether pipe culvert or box culvert or iron bridge, length of spans, etc., so that this book shows just what structure I am coming to, and I proceed from division to division until I get over the entire system. I also have a book for the buildings, in which I note everything in connection with the buildings; the condition they are in and what is necessary to be done, and when anything is dangerous or wants immediate attention I report it at once. But anything that is ordinary or which does not call for special attention I say nothing about until I get through with the annual inspection. From one of the road to the other end is some 1,650 miles, which takes about four months. I would further say that this report is used largely for next year's estimate of work to be done. I keep a description of every structure, the size of it, the height of it, number of rooms, two waiting-rooms, or one and an office, or combined station and dwelling, whatever it is, is all put down. These books I have used for the past nine years; I have them all filed in such a way that I can turn back in a minute or two to any inspection I made six, or five or nine years ago, and ascertain just what I found at that structure at that time. Also keep a record of what has been done; as to whether a new structure has been put in, etc., so that I am able to find anything on the road of any description, in the way of bridges or buildings, at short notice.

President.—Gentlemen, is there anything further on this subject of records and accounts? If not I declare the subject closed, and a motion will now be entertained to adjourn until 9 o'clock tomorrow morning, at which time we will have a good many important things to attend to in the way of election of officers, deciding on place for holding our next annual meeting, etc. If no objections we will now stand adjourned until 9 o'clock tomorrow morning.

PAPER ON WESTERN AUSTRALIAN GOVERNMENT RAILWAYS.[1]

By E. S. HUME, *Chief Mechanical Engineer.*

METHODS OF WATERING STOCK IN TRANSIT.

On the Western Australian Government Railways stock is not watered in transit. The maximum distance stock is railed is 598 miles, and the time taken on the journey about 33 hours. In the other Australian states no provision is made for watering stock on the journey. In South Australia stock is railed from Oodnadatta to Adelaide (688 miles), a journey of 45 hours, during which stock is not watered.

PROTECTION OF WATER TANKS AND WATER PIPES FROM ACTION OF FROST.

The climate in Western Australia is too mild for tanks and pipes to be affected by frost.

WATER SUPPLY.

Dams are constructed at suitable places where rainfall can be conserved. Supplies are also obtained from bores and wells where the water is good, also from the Coolgardie water scheme, which follows the railway line from Lion Mill to Kalgoorlie, a distance of 350 miles.

A sextuple effect Yaryan evaporator is in operation at Geraldton and condenses 33,600 gallons of sea water per day of 24 hours. The capital cost of the plant erected is £8,500, and the cost of condensing per 1,000 gallons for year ended June 30, 1905, is as follows:

Interest, 4% on £8,500	£340	0	0
Depreciation, 5% on £8,500	425	0	0
Cost of working	862	7	9
Administration, 5% on working	43	2	4
Repairs	249	9	1
Total	£1,919	19	2

Water condensed, 3,368,750 gallons, or 11/4.8 per 1,000.

This evaporator was obtained from Mirrlees Watson Co., Glasgow, and is working satisfactorily. Some trouble was experienced in the initial stages of operation through the condenser tubes pitting. This was overcome when a new set of brass tubes was put in.

Water is softened by the Archbutt-Deeley process, at the Fremantle Railway electric power house. The original analysis of water treated was:

[1] Received too late for presentation at the Convention.

Calcium carbonate	3.66
Sodium chloride	59.8
Sodium sulphate	4.68
Sodium carbonate	1.5
Magnesium carbonate	3.72
Silica	1.26
Iron and alumina oxides	0.14
Total solids (grains per gallon)	74.76
Hardness (degrees)	8.8

This treatment, using 12 oz. soda carbonate and 80 oz. slaked lime, reduced the hardness to 3.16 degrees, at a cost of 1¾d. per 1,000 gallons for chemicals. Using 16 oz. caustic soda per 1,000 gallons in place of the soda carbonate and slaked lime reduced the hardness to 4.16 degrees at a cost of 1⅞d. per 1,000 gallons.

One Kennicott and one Archbutt-Deeley softening plant, each of 2,000 gallons capacity per hour, have been ordered to treat water on the Malcolm Laverton Railway at Fauld's Well and Laverton Public Battery. The analysis of water to be treated is:

	Fould's well.	Laverton Public Battery.
Insoluble matter—silica	3.40	7.85
Iron and alumina	.18	.15
Sulphate of lime	.24	.24
Sulphate of magnesia	.17	1.95
Sulphate of soda	4.03	9.05
Carbonate of lime	10.03	9.29
Carbonate of magnesia	4.85	5.29
Carbonate of soda	3.56	
Chloride of magnesia		
Chloride of sodium	23.33	19.87
Total solids (grains per gallon)	49.79	53.69
Hardness (degrees)	22.5	18.00

FIRE PROTECTION.

At locomotive depots and workshops an efficient fire brigade is formed from the locomotive employés working at such depots or shops. Proper appliances are also provided to cope with an outbreak of fire.

PRESERVATIVES FOR WOOD AND METAL.

Copy of specification for painting cars and brake-vans is attached:

In regard to new wagons built, the underframe, sides and ends are painted with one coat of Para Para Hematite. The outside of the wagon, including the wooden sole bars, is then stopped with putty, and machine-painted with two coats of hematite. The inside is machine-painted with one coat of hematite. The undergear is painted with one coat of black tar preservative.

COALING STATIONS AND CINDER PITS.

At two of the principal depots, viz., Northam and Kalgoorlie, overhead coaling stages are erected. The coal is conveyed to the top of the stages by means of hopper trucks which are pushed up a ramp by an ordinary locomotive. The appliances for filling the tenders from the stage have not yet been satisfactorily arranged. The installation of modern mechanical coaling plants at the depots, with bucket elevators, is now under consideration. Where the head of water from the Coolgardie water scheme is sufficient, power will be generated by means of a Pelton wheel where this water is available.

Cinder Pits. These have been constructed where required and are emptied by hand. The quantity of cinders dealt with is too limited to warrant the installation of mechanical means for dealing with them.

RECORDS AND ACCOUNTS.

One copy of the Annual Report on the working of the Western Australian Government Railways for year ended June 30, 1904, has been forwarded under separate cover. The principal records kept and classification of accounts, also map of railway system, can be seen from this report.

WESTERN AUSTRALIAN GOVERNMENT RAILWAYS.

SPECIFICATION FOR PAINTING AND FINISHING 58FT. FIRST-CLASS SUBURBAN CARS.

A. *Body Exterior.*

To receive the following treatment:

(1) To be primed with two (2) good coats of lead color in oil.

(2) To be stopped with hard stopping, consisting of dry white lead and gold size.

(3) To receive five (5) coats of filling, composed of "patent filling," white lead, gold size, turpentine and varnish. The last coat of these five to be tinted "Indian Red."

(4) To be thoroughly "rubbed down" to a smooth level face with lump pumice stone and water.

(5) To receive two (2) coats lead color in oil, one (1) coat Indian Red in oil, and one (1) coat Indian Red in oil with varnish added.

(6) To be picked out "dark brown" (of approved tint), then varnished with one (1) coat hard body varnish, flattened down, "fine lined" in yellow of approved tint, and to approved pattern, and "written" as follows:

The word "First" on each compartment door, the word "Guard" on each door of the guard's compartment, and the word "Luggage" on the double doors. The letters and numerals to be exactly similar in size and design to sample tablet herewith.

(7) To receive a coat of hard body varnish, flattened and then finished with one (1) coat of best "finishing body varnish."

B. *Roof.*

The roofs are to be painted and covered with the material specified in the general specification No. 142.

After the top roof has received the two (2) priming coats,

it must be covered with a layer of white lead in oil, at least one-eighth inch in thickness; and whilst this is wet, the roofing canvas is to be stretched very tightly over the whole surface and the white lead underneath well worked through and into the canvas by rubbing and pressure. The canvas must be thoroughly secured to the cant rails, care being taken to produce a smooth surface over all corners and on the end canopies. After the outside of the canvas is dry, it is to receive three (3) coats of white lead paint in raw linseed oil. The flat surface of the cornice moldings is to be thickly coated with white lead paint before they are fastened over the canvas, so as to prevent water getting between the canvas and the moldings. Roof facia boards are to receive three (3) coats of deep buff color, and grained imitation teak, and finished with varnish same as other exterior woodwork.

C. *Floor Boards and Framing.*

The floor boards and the whole of the interior of the framing, and all panel backs, boards, roof frames and bearers, etc., must be primed and afterwards painted with two (2) coats of best oil paint. The last coat on top side of floor to be brown color.

D. *Body Interior.*

All teak panels, molding and lining, etc., in the passenger compartments are to be thoroughly "bodied in," and a good brilliant, level surface produced with French polish; and all pin holes, etc., are to be carefully stopped.

Lincrusta panels in ceiling are to receive two (2) coats of white lead in oil, and one (1) coat "Hubbuck's" white zinc varnish color.

All other Lincrusta panels are to be finished "Ivory white." The paint used on all Lincrusta panels is to be applied thin, flat color, and stippled, so that the sharpness of the pattern may be retained.

E. *Brake Compartments. Interior.*

All lining boards and face of framing inside to receive two (2) coats of lead priming, all screw and nail holes to be carefully stopped with oil putty, then two (2) coats of buff color are to be applied and the whole grained in imitation of oak and varnished with one (1) coat of hard body varnish, and finally with one (1) coat of pale carriage varnish. Teak faces and moldings are to be finished as specified for passenger compartments. Ceiling to receive two (2) coats of white lead paint and one (1) coat of "Hubbuck's" zinc white (varnish color). Floor to be painted lead color. Brake columns and fittings to be primed and receive two (2) coats of lead color and finished with one (1) coat of black Japan.

F. *Lights.*

Outside portion of frames to be bodied in with two (2) coats of gold size (stopped with lead stopping stained to match the wood), and a sufficient number of coats of hard body varnish applied to produce a level surface, then "faced up" with pumice stone and water, and then receive two coats of hard body, and one (1) coat of best finishing varnish. The inside of frames to be finished as specified for interior teak work in compartments.

G. *Underframes, Etc.*

All steel and ironwork to be thoroughly freed from rust, dust and dirt before painting. Bolts, knees and other ironwork used in the manufacture of body-parts to be primed with oil color before being fixed. The whole of ironwork of bogies, underframes, wheels, axles, brake-gear, etc. (excepting outside of channel bars), to be painted with two (2) coats of oil lead color and one (1) coat of black lacquer.

The outside of channel bars to receive two (2) coats of oil lead color, stopped with hard stopping, then four (4) coats of patent filling, rubbed down to a level face with pumice stone and water, two (2) coats of lead color, then sandpapered and finally finished with one (1) coat of quick black, one (1) coat of varnish black and two (2) coats of varnish.

H. *General.*

In every case there must be at least one clear day between each coat of paint; one coat of filling up may be applied daily; but the work must then stand at least three (3) clear days before being rubbed down and at least two (2) days must be allowed between each coat of varnish.

Champion's genuine No. 1 white lead to be used throughout. Lacquer, gold size and varnishes to be Harland's or Noble & Hoare's. Oils and other materials to be the best of their respective kinds, and of approved brands.

E. S. HUME,
Chief Mechanical Engineer.

Chief Mechanical Engineer's Office,
Fremantle, Oct. 5, 1904.

WESTERN AUSTRALIAN GOVERNMENT RAILWAYS.

SPECIFICATION FOR PAINTING AND VARNISHING EXPRESS BRAKE VANS.

A. *Body Exterior.*

To be treated as follows:

(1) The teak portions of the exterior to receive one coat of gold size and turps in equal quantities, then the sides to be primed with two coats of lead color in oil and the ends with two coats of flesh color in oil.

(2) All nail and screw holes, cracks, etc., to be carefully filled with oil putty.

(3) The sides are then to receive one coat of lead color in oil, one coat Indian red in oil and one coat Indian red in oil with varnish added, then picked out "dark brown" of approved tint. The ends are to receive one coat of lead color in oil, then two coats of English vermillion.

(4) The whole exterior is then to be finished with two coats of hard body varnish and one coat of finishing varnish.

B. *Roof.*

The upper side of both roofs and under side of top roof are to be primed with two coats of lead color in oil, and afterwards the top of both roofs must receive a thick coat of white lead in raw linseed oil—the total quantity for the outer roof to be not

less than three cwt., of a consistency of three quarts of oil to one cwt. of white lead. Before these coats are dry the roofing canvas is to be stretched very tightly over the whole surface and the white lead underneath well worked through and into the canvas by rubbing and pressure. A thick coat of white lead is to be applied between the side strips of canvas and that on the inner roof, and the side strips are then to be treated in the same manner as the inner roof canvas.

After the outside of canvas is dry, three coats of white lead paint in raw linseed oil are to be applied to the outer roof and two coats to the inner roof. The flat surfaces of the securing strips are to be thickly coated with white lead paint before they are fastened over the canvas, so as to prevent water getting between the canvas and the strips. Roof facia boards all round are to be painted and finished in the same manner as the sides.

C. *Floor Boards and Framing.*

The floor boards and the whole of the framing between inside and outside lining, the back of all lining and partition boards, floor bearers, etc., are to be primed and afterwards painted with two coats of best oil paint. The last coat on top side of floor to be brown color.

D. *Body Interior.*

All lining boards and inside faces of framing are to receive four coats of stone color paint; all nail and screw holes, etc., to be filled with putty between the second and third coats. The ceiling to receive three coats of white lead in oil and finished with one coat of zinc white varnish color. All defects to be puttied after priming coat. Brake columns and fittings to be primed and receive two coats of lead color and finished with one coat of black Japan.

E. *Lights.*

Outside and inside of light frames to be bodied in with two coats of gold size (stopped with lead stopping, stained to match the wood); and a sufficient number of coats of hard body varnish applied to produce a level surface, then "faced up" with pumice stone and water and finished with two coats of hard body and one coat of best finishing varnish.

F. *Underframes.*

All steel and ironwork to be thoroughly free from rust, dust and dirt before painting. Bolts, knees and other ironwork used in the manufacture of body parts to be primed with oil color before being fixed.

The whole of the iron work for bogies, underframes, wheels, axles, brake gear, etc. (excepting outside of channel bars), to be painted with one coat of black lacquer.

The outside of channel bars are to receive two coats of lead color in oil, stopped with hard stopping, then four coats of patent filling, rubbed down to a level face with pumice stone and water, two coats of lead color in oil, then sandpapered and finally finished with one coat of quick black, one coat of varnish black and two coats of varnish.

G. *General.*

In every case there must be at least 24 hours between each coat of paint and 48 hours between each coat of varnish; one coat of filling up may be applied daily, but the work must then stand at least three clear days before being rubbed down.

Champion's genuine No. 1 white lead to be used throughout. Lacquer, gold size and varnishes are to be "Harland's" or "Noble & Hoare's." Oils and other materials to be the best of their respective kinds and of approved brand.

E. S. HUME,
Chief Mechanical Engineer.

June 26, 1905.

WELLINGTON, NEW ZEALAND, November 10, 1905.

S. F. PATTERSON, Secretary.

Dear Sir: I notice that the subjects to be discussed at the Convention held in October comprised many things that we don't use at present in New Zealand. Piles on our railway are of a timber called totara. They have been in the ground for about twenty years and where piles are replaced we are now using an Australian timber called iron bark. No concrete piles are used; where concrete has been used for piles tubing has been driven and then filled with concrete, and that is only done on reclaimed ground for foundation of buildings to build brick walls on. Our platforms are mostly timber, although the timber is of a soft nature and durable compared to many other timbers. I expect we will have to renew in brick or concrete, so I will be pleased to hear what conclusions you arrived at in your discussions on the different subjects. If there is any subject you would like to ask me about and you let me know, I will be very pleased to do all I can to further the objects of the Association.

Yours truly,

ARTHUR WILLIAMS,
Wellington & Manawata Railway.

LIST OF ANNUAL CONVENTIONS.

First,	St. Louis, Mo.,	September 25, 1891.
Second,	Cincinnati, Ohio,	October 18, 19, 1892.
Third,	Philadelphia, Pa.,	October 17 to 19, 1893.
Fourth,	Kansas City, Mo.,	October 16 to 18, 1894.
Fifth,	New Orleans, La.,	October 15, 16, 1895.
Sixth,	Chicago, Ill.,	October 20 to 22, 1896.
Seventh,	Denver, Col.,	October 19 to 21, 1897.
Eighth,	Richmond, Va.,	October 18, 19, 1898.
Ninth,	Detroit, Mich.,	October 17, 18, 1899.
Tenth,	St. Louis, Mo.,	October 16 to 18, 1900.
Eleventh,	Atlanta, Ga.,	October 15 to 17, 1901.
Twelfth,	Minneapolis, Minn.,	October 21 to 23, 1902.
Thirteenth,	Quebec, Canada,	October 20 to 22, 1903.
Fourteenth,	Chicago, Ill.,	October 18 to 20, 1904.
Fifteenth,	Pittsburg, Pa.,	October 17 to 19, 1905.

MEMBERSHIP.

Year 1891–2. . . .	Number of active members, 60.
Year 1892–3. . . .	Number of active members, 112.
Year 1893–4. . . .	Number of active members, 128.
Year 1894–5. . . .	Number of active members, 115.
Year 1895–6. . . .	Number of active members, 122.
Year 1896–7. . . .	Number of active members, 140.
Year 1897–8. . . .	Number of active members, 127.
Year 1898–9. . . .	Number of active members, 148.
Year 1899–1900. . .	Number of active members, 148.
Year 1900–01. . . .	Number of active members, 143.
Year 1901–02.	Number of active members, 171.
Year 1902–03. . . .	Number of active members, 195.
Year 1903–04. . . .	Number of active members, 223.
Year 1904–05. . . .	Number of active members, 293.
Year 1905–06. . . .	Number of active members, 313.

LIST OF OFFICERS OF THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS FROM ITS ORGANIZATION TO THE YEAR 1905-1906.

YEAR.	1891-2.	1892-3.	1893-4.	1894-5.
President	O. J. Travis	H. M. Hall	J. E. Wallace	Geo. W. Andrews.
First Vice-President	H. M. Hall	J. E. Wallace	Geo. W. Andrews	W. A. McGonagle.
Second Vice-President	J. B. Mitchell	G. W. Hinman	W. A. McGonagle	L. K. Spafford.
Third Vice-President	James Stannard	N. W. Thompson	L. K. Spafford	James Stannard.
Fourth Vice-President	G. W. Hinman	C. E. Fuller	E. D. Hines	Walter G. Berg.
Secretary	C. W. Gooch	S. F. Patterson	S. F. Patterson	S. F. Patterson.
Treasurer	George M. Reid	George M. Reid	George M. Reid	George M. Reid.
Executive Members	W. R. Damon	G. W. Andrews	Quintine McNab	James Stannard.
	G. W. Markley	Joseph M. Staten	Aaron S. Markley	James H. Travis.
	W. A. McGonagle	J. M. Caldwell	Floyd Ingram	Joseph H. Cummin.
	G. W. McGehee	Quintine McNab	James Stannard	R. M. Peck.
	G. W. Turner	Floyd Ingram	James H. Travis	J. L. White.
	J. E. Wallace	Aaron S. Markley	Joseph H. Cummin	A. Shane.

YEAR.	1895-6.	1896-7.	1897-8.	1898-9.
President	W. A. McGonagle	James Stannard	Walter G. Berg	Joseph H. Cummin.
First Vice-President	L. K. Spafford	Walter G. Berg	Joseph H. Cummin	Aaron S. Markley.
Second Vice-President	James Stannard	Joseph H. Cummin	Aaron S. Markley	C. C. Mallard.
Third Vice-President	Walter G. Berg	Aaron S. Markley	G. W. Hinman	Walter A. Rogers.
Fourth Vice-President	Joseph H. Cummin	R. M. Peck	C. C. Mallard	Joseph M. Staten.
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson.
Treasurer	George M. Reid	N. W. Thompson	N. W. Thompson	N. W. Thompson.
Executive Members	R. M. Peck	W. O. Eggleston	George J. Bishop	Wm. S. Danes.
	J. L. White	W. M. Noon	C. P. Austin	J. H. Markley.
	A. Shane	Joseph M. Staten	M. Riney	W. O. Eggleston.
	Aaron S. Markley	George J. Bishop	Wm. S. Danes	R. L. Heflin.
	W. M. Noon	C. P. Austin	J. H. Markley	Frank W. Tanner.
	Joseph M. Staten	M. Riney	W. O. Eggleston	A. Zimmerman.

LIST OF OFFICERS OF THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS FROM ITS ORGANIZATION TO THE YEAR 1905-1906.

YEAR.	1899-1900.	1900-1901.	1901-1902.	1902-1903.
President	Aaron S. Markley	W. A. Rogers	W. S. Danes	B. F. Pickering.
First Vice-President	Walter A. Rogers	W. S. Danes	B. F. Pickering	C. C. Mallard.
Second Vice-President	Joseph M. Staten	B. F. Pickering	A. Shane	A. Shane.
Third Vice-President	Wm. S. Danes	A. Shane	A. Zimmerman	A. Zimmerman.
Fourth Vice-President	B. F. Pickering	A. Zimmerman	C. C. Mallard	A. Montzheimer.
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson.
Treasurer	N. W. Thompson	N. W. Thompson	N. W. Thompson	N. W. Thompson.
Executive Members	T. M. Strain	T. M. Strain	A. Montzheimer	W. E. Smith.
	R. L. Heflin	H. D. Cleaveland	W. E. Smith	A. W. Merrick.
	F. W. Tanner	F. W. Tanner	A. W. Merrick	C. P. Austin.
	A. Zimmerman	A. Montzheimer	C. P. Austin	C. A. Lichty.
	H. D. Cleaveland	W. E. Smith	C. A. Lichty	W. O. Eggleston.
	A. Montzheimer	A. W. Merrick	W. O. Eggleston	J. H. Markley.

YEAR.	1903-1904.	1904-1905.	1905-1906.	1906-1907.
President	A. Montzheimer	C. A. Lichty	J. B. Sheldon	
First Vice-President	A. Shane	J. B. Sheldon	J. H. Markley	
Second Vice-President	C. A. Lichty	J. H. Markley	R. H. Reid	
Third Vice-President	J. B. Sheldon	R. H. Reid	R. C. Sattley	
Fourth Vice-President	J. H. Markley	R. C. Sattley	J. P. Canty	
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	
Treasurer	C. P. Austin	C. P. Austin	C. P. Austin	
Executive Members	R. H. Reid	W. O. Eggleston	H. Rettinghouse	
	W. O. Eggleston	A. E. Killam	A. E. Killam	
	A. E. Killam	H. Rettinghouse	J. S. Lemond	
	R. C. Sattley	J. S. Lemond	C. W. Richey	
	H. Rettinghouse	W. H. Finley	H. H. Eggleston	
	J. S. Lemond	C. W. Richey	F. E. Schall	

SUBJECTS FOR REPORT AND DISCUSSION, AND COMMITTEES SELECTED AT EACH CONVENTION SINCE ORGANIZATION OF THE ASSOCIATION IN 1891.

FIRST CONVENTION, ST. LOUIS, MO., SEPTEMBER 25, 1891.

Subjects.	Committees.
1. Surface Cattle-Guards	Aaron S. Markley, J. B. Mitchell, W. R. Damon.
2. Frame and Pile Trestles Complete, including Reraller	H. M. Hall, W. A. McGonagle, G. W. McGehee.
3. Framing and Protection of Howe Truss and Other Wooden Bridges against Fire and Decay	J. E. Johnson, G. W. Markley, J. H. Markley.
4. Iron and Vitrified Pipe for Waterways under Railroad Embankments	James Stannard, J. O. Thorn, J. E. Wallace.
5. Water-Tanks Complete, including Painting, Pumps, Pump and Coal Houses, Wells and Reservoirs	G. W. Turner, R. K. Ross, Q. McNab.
6. Interlocking Signals	B. F. Bond, G. W. Hinman, James Demars.
7. Depot Platforms, Complete	J. A. Nicholson, Adam McNab, C. B. Keller.
8. Paints for Iron Structures	Geo. M. Reid, A. J. Kelley, H. A. Hanson.

SECOND CONVENTION, CINCINNATI, O., OCTOBER 18 AND 19, 1892.

1. Discipline, and Benefits Derived, and Who are the Beneficiaries	Geo. W. Andrews, W. R. Damon, T. M. Strain, G. W. Turner.
2. Turn-table, Best, with a View of Economy, and Durability, and Strength	G. W. Markley, H. F. Martin, James H. Travis, Charles Walker.
3. Water Columns, Best, Cheapest, Simplest, and Most Durable	C. E. Fuller, A. S. Markley, H. N. Spaulding, E. L. Cary.
4. Coaling Stations, including Storage Bins and for Coaling Engines	J. E. Wallace, C. W. Gooch, G. W. Hinman, J. H. Cummin.

5.

Crawling of Rails, and its Effects on Structures...... — Geo. M. Reid, L. K. Spafford, J. B. Mitchell, L. S. Isdell.

6.

Guard-Rails on Bridges, Advantages and Disadvantages, and Best to be Adopted........................ — O. J. Travis, Q. McNab, J. F. Mock, J. M. Staten.

7.

Platforms, Height and Distance from Rail and Mode of Construction.. — James Stannard, M. Walsh, N. M. Markley, Robert Ogle.

8.

Best Bridge, Wood, Combination, or Iron, from 130 feet and upwards, and the Best Method of Reconstruction... — A. Shane, Walter Ransom, N. Potter, C. G. Worden.

9.

Best Method of Elevating Track upon Bridges and Trestles.................. .... — H. E. Gettys, S. F. Patterson, G. W. Hinman, P. A. Watson.

THIRD CONVENTION, PHILADELPHIA, PA., OCT. 17, 18, AND 19, 1893.

1.

Depressed Cinder Pits and Other Kinds............... — W. G. Berg, Abel S. Markley, G. W. Andrews, C. E. Fuller.

2.

Best Method of Bridge Inspection..................... — G. M. Reid, J. M. Staten, E. T. Wise, J. S. Berry.

3.

Pumps and Boilers... — G. W. Markley, G. W. Turner, J. B. Mitchell, J. R. Harvey.

4.

Maintenance of Pile and Frame Trestle......... .... — W. A. McGonagle, J. H. Markley, Geo. C. Nutting, John Copeland.

5.

The Best Scale Foundation............................. — O. J. Travis, Joseph Doll, C. E. Wadley, T. M. Strain.

FOURTH CONVENTION, KANSAS CITY, MO., OCT. 16, 17, AND 18, 1894.

1.

Mechanical Action and Resultant Effects of Motive Power at High Speed on Bridges .... — G. W. Andrews, W. G. Berg, J. E. Greiner, E. H. R. Green.

2.

Methods and Special Appliances for Building Temporary Trestles over Washouts and Burnouts...... — R. M. Peck, G. J. Bishop, A. B. Manning, C. D. Bradley.

3.

Strength of Various Kinds of Timber Used in Trestles and Bridges, Especially with Reference to Southern Yellow Pine, White Pine, Fir, and Oak... — W. G. Berg, J. H. Cummin, John Foreman, H. L. Fry.

4.

Best Method of Erecting Plate-Girder Bridges .. { H. M. Hall, J. M. Staten, G. W. Hinman, J. N. Pullen.

5.

Best and Most Economical Railway Track Pile-Driver.......... { J. L. White, A. C. Davis, J. F. Mock, James T. Carpenter.

6.

Sand Dryers, Elevators, and Methods of Supplying Sand to Engines, including Buildings.......... { Aaron S. Markley, H. A. Hanson, A. J. Kelley, J. O. Thorn.

7.

Span Limits for Different Classes of Iron Bridges, and Comparative Merits of Plate-Girders and Lattice-Bridges for Spans from 50 to 110 feet.......... { W. A. McGonagle, R. M. Peck, W. M. Noon, H. E. Gettys.

8.

Best Method of Spanning Openings too Large for Box Culverts, and in Embankments too Low for Arch Culverts.......... { James Stannard, L. K. Spafford, O. H. Andrews, F. W. Tanner.

9.

Best End Construction for Trestle Adjoining Embankments.......... { G. M. Reid, J. L. Soisson, N. M. Markley, R. J. Howell.

10.

Interlocking Signals.......... { J. H. Travis, W. S. Danes, R. L. Heflin, J. A. Spangler.

11.

Pumps and Boilers.......... { John H. Markley, O. J. Travis, A. Shane, G. W. Markley.

FIFTH CONVENTION, NEW ORLEANS, LA., OCTOBER 15 AND 16, 1895.

1.

How to Determine Size and Capacity of Openings for Waterways.......... { Aaron S. Markley, J. S. Berry, C. C. Mallard, J. L. White.

2.

Different Methods of Numbering Bridges. Should All Waterways be Numbered ?.......... { A. Shane, W. O. Eggleston, J. L. Slosson, O. J. Travis.

3.

Drawbridge Ends, Methods of Locking; and under this head include Locking of Turn-tables.......... { H. M. Hall, James Stannard, H. Middaugh, C. C. Mallard.

4.

Protection of Trestles from Fire, including Methods of Construction.......... { R. M. Peck, T. H. Kelleher, A. McNab, W. M. Noon, G. W. Hinman, William Berry.

5.

Local Stations for Small Towns and Villages, giving Plans of Buildings and Platforms.......... { J. H. Cummin, N. M. Markley, J. H. Markley, C. G. Worden.

6.

Tanks, Size, Style, and Details of Construction, including Frost-proof protection to Tank and Pipes.. { W. O. Eggleston, W. M. Noon, A. McNab, N. W. Thompson.

7.

Shearing of Rivets in Plate-Girders and Cause Thereof.. J. M. Staten, R. L. Heflin, J. H. Travis, G. M. Reid.

8.

Best and Uniform System of Report Blanks for Bridge and Building Department.................... G. J. Bishop, W. O. Eggleston, Onward Bates, M. Riney.

9.

Protection of Railroad Structures and Buildings from Fire.. R. M. Peck, L. K. Spafford, B. T. McIver.

10. Brought forward from 1894.

Mechanical Action and Resultant Effects of Motive Power at High Speed on Bridges.................... G. W. Andrews, W. G. Berg, J. E. Greiner, E. H. R. Green.

11. Brought forward from 1894.

Best and Most Economical Railway Track Pile-Driver.. J. L. White, A. C. Davis, J. F. Mock, J. T. Carpenter, G. W. Hinman.

12. Brought forward from 1894.

Span Limits for Different Classes of Iron Bridges, and Comparative Merits of Plate-Girders and Lattice Bridges for Spans from 50 to 110 feet........... W. A. McGonagle, R. M. Peck, W. M. Noon, H. E. Gettys, G. J. Bishop, Onward Bates.

13. Brought forward from 1894.

Interlocking Signals.................................. J. H. Travis, W. S. Danes, R. L. Heflin, J. A. Spangler.

SIXTH CONVENTION, CHICAGO, ILL., OCTOBER 20, 21, AND 22, 1896.

1.

Methods of Heating Buildings where Three or More Stoves are Now Used.................................. J. H. Cummin, George W. Hinman, George W. Markley, Wm. Berry.

2.

The Most Suitable Material for Roofs of Buildings of All Kinds.. R. M. Peck, G. W. Turner, W. M. Noon, N. W. Thompson.

3.

Roundhouse Construction, including Smoke-jacks and Ventilators.................................. Geo. W. Andrews, O. J. Travis, W. O. Eggleston, James T. Carpenter.

4.

Care of Iron Bridges after Erection.................. James H. Travis, T. M. Strain, H. M. Hall, Walter Rogers.

5.

How to Determine Size and Capacity of Openings for Waterways.................................. Walter G. Berg, Aaron S. Markley, Onward Bates, A. J. Kelley.

6.

Protection of Railroad Buildings and Other Structures from Fire .... { W. A. McGonagle, M. M. Garvey, J. D. Hilderbrand, John Foreman.

7.

Designs for Ice-Houses .... { W. B. Yereance, C. M. Large, J. H. Markley, Geo. W. Ryan.

8.

Best End Construction for Trestles adjoining Embankments .... { C. C. Mallard, W. S. Danes, R. L. Heflin, A. C. Olney.

9.

Bridge Warnings for Low Overhead Structures..... { W. E. Harwig, M. A. Martin, E. H. R. Green, Joseph Doll.

10.

Stock-yards and Stock-sheds, including all Details of Construction .... { Geo. J. Bishop, W. R. Cannon, O. H. Andrews, James Brady.

11.

Floor System on Bridges, including Skew Bridges... { W. G. Guppy, C. P. Austin, C. W. Gooch, F. W. Tanner.

SEVENTH CONVENTION, DENVER, COL., OCTOBER 19, 20, AND 21, 1897.

1.

Pile-rings and Method of Protecting Pileheads in Driving .... { G. W. Hinman, Wm. S. Danes, F. Eilers, E. F. Reynolds, Wm. Carmichael, C. M. Large.

2.

Cost and Manner of Putting In Pipe Culverts..... ... { Walter A. Rogers, Frank W. Tanner, John H. Markley, A. H. King, B. F. Bond, O. H. Andrews.

3.

Best Floors for Shops and Roundhouses .... { A. W. Merrick, C. S. Thompson, Wm. O. Eggleston, M. F. Cahill, J. B. Pullen, James Gilbert.

4.

Roundhouse Smoke-jacks and Ventilation .... { George W. Andrews, Wm. O. Eggleston, Aaron S. Markley, R. J. Howell, J. T. Carpenter, A. McNab.

5.

Cattleguards and Wingfences .... { C. C. Mallard, C. S. Thompson, A. Zimmerman, L. H. Wheaton, O. W. Osborne, R. L. Heflin.

6.

Prevention of Fire in Railroad Buildings.............. { John D. Isaacs, Wm. A. McGonagle, M. Riney, H. L. Fry, J. P. Snow, Wm. B. Yearance.

7.	
Storage of Fuel, Oil, and Other Station Supplies at Way-stations..............................	Arthur Montzheimer, A. Shane, G. E. Hanks, J. E. Johnson, W. Z. Taylor, E. M. Gilchrist.
8.	
Railroad Highway Crossing Gates.....................	Joseph H. Cummin. J. B. Sheldon, Wm. E. Harwig, G. W. Smith, J. E. Featherston, W. M. Noon.
9.	
What Repairs, and How Can they be Safely Made, to Metal and Wooden Spans Without the Use of False-work	F. S. Edinger, B. W. Guppy, J. E. Greiner, John D. Isaacs, Walter A. Rogers, H. W. Fletcher.
10.	
Care of Iron Bridges After Erection, including Best Method of Protecting Them From Injury by Salt Water Drippings from Refrigerator cars............	J. E. Greiner, B. W. Guppy, James McIntyre, T. M. Strain, A. J. Kelley, L. F. Goodale.
11.	
Turntable Construction....................................	Onward Bates, J. B. Sheldon, D. K. Colburn, John Foreman, E. Fisher, Henry Goldmark.

EIGHTH CONVENTION, RICHMOND, VA., OCTOBER 18 AND 19, 1898.

1.	
What is the Most Economical Method of Painting Railway Bridges and Buildings, and Best Material to use	A. Montzheimer, B. F. Pickering, H. D. Cleaveland, W. A. McGonagle.
2.	
Life of Different Kinds of Timber in Bridges of Various Kinds, and Advisability of Protecting Same from the Weather......	B. W. Guppy.
3.	
The Best Method of Constructing and Maintaining Highway and Farm Crossings........................	J. H. Markley, W. O. Eggleston, T. M. Strain, O. J. Travis.
4.	
Best Practical Sanitary Arrangement for Local Stations where there are no Water or Sewer Systems.	W. A. Rogers, J. B. Sheldon, C. H. Miller, J. McIntyre.
5.	
Best and Most Economical Plant for Pumping Water for Water Stations...........................	A. Shane, A. S. Markley, R. L. H· flin, W. E. Smith.
6.	
Necessary and Kind of Tools for the Proper Equipment of a Gang of Bridge Men.	G. J. Bishop, G. W. Hinman, M. Riney, A. Zimmerman.

7.

Best Snow Fence—Stationary and Portable	A. W. Merick, A. E. Killam, J. D. Isaacs. A. H. King.

8. Brought forward from 1897.

What Repairs and How Can They Be Safely Made to Metal and Wood Spans Without the Use of False Work	F. S. Edinger, J. E. Greiner, J. D. Isaacs, W. A. Rogers, H. W. Fletcher.

9. Brought forward from 1897.

Prevention of Fire in Railroad Buildings..............	G. W. Andrews, A. D. Schindler, W. E. Smith, S. B. Rice.

NINTH CONVENTION, DETROIT, MICH., OCTOBER 17 AND 18, 1899.

1. Brought forward from 1898.

Necessary and Kind of Tools for the Equipment of a Gang of Bridge Men..................................	W. S. Danes, J. M. Staten, W. O. Eggleston, J. M. Caldwell.

2. Brought forward from 1898.

Best Snow Fence, Stationary or Portable.............	W. E. Smith, A. McNab, Geo. E. Hanks, A. W. Merrick. W. M. Noon.

3.

Best Method of Erecting Track Scales, Suspended or under Track........	H. D. Cleveland, Wm. M. Clark, C. P. Austin, J. T. McIlwaine.

4.

Is Concrete the Most Suitable and Economical Material for Bridge Piers and Abutments and Railway Culverts and Arches ?.................................	W. A. Rogers.

5.

Hand *vs.* Air-riveting Power Used. Actual Cost Compared with Hand Work in the Field for the Erection of New Work and Repairing; also Drilling for Reinforcing old Spans.......................	A. B. Manning, A. Shane, Geo. J Bishop, O. J. Travis, F. W. Tanner, F. S. Edinger.

6.

Most Practical and Cheapest Bumper for Yard Terminals...	B. F. Pickering, A. A. Page, W. E. Harwig, A. E. Killam.

7.

Are Tie Plates on Bridge Ties a Benefit or a Detriment ?..	C. A. Lichty, A. Montzheimer, C. W. Vandergrift, H. W. Fletcher, F. S. Edinger, J. B. Sheldon.

TENTH CONVENTION, ST. LOUIS, MO., OCT. 16, 17, AND 18, 1900.

1.

Methods of Sinking Foundations for Bridge Piers in Depth of Water Twenty Feet and Under...........	G. W. Andrews, C. C. Mallard, C. A. Lichty, C. W. Gooch, C. S. Thompson, D. Robertson.

2.

Passenger Platforms at Way Stations, Best Material and Cost of Same.....................	J. B. Sheldon, John I. Banks, N. H. LaFountain, L. H. Wheaton, Wm. A. Fort, A. McNab.

3

Slips for Ferry Boats Used for Transferring Railway Cars..............................	John D. Isaacs, H. D. Cleaveland, J. H. Cummin, Charles Carr, H. Rettinghouse, J. T. Carpenter

4.

Best Method of Operating Turn-tables by Power.....	F. E. Schall, J. E. Greiner, B. F. Pickering, Onward Bates.

5.

Auxiliary Coaling Stations; Best Design, Capacity, and Method of Handling Coal.........................	W. A. McGonagle, G. W. Smith E. Fisher, J. P. Snow, B. F. Bond, R. B. Tweedy.

6.

Water Stations; Best Material for Foundations, Tanks, Substructure, Connections, Capacity, etc...	A. S. Markley, Charles Carr, W. O. Eggleston, A. J. Austin A. Shane.

7.

Is it Best for Railroad Companies to Erect Their Own Steel Structures, or Let the Manufacturers Erect Them?....................................... ...	O. J. Travis, F. S. Edinger, A. B. Manning, James McIntyre, A. Zimmerman.

8.

The Best and Most Convenient Outfit Cars for Bridge Gangs, and Number of Men Constituting a Bridge Gang..	A. W. Merrick, S. S. Millener, Wm. M. Clark, A. A. Page, M. F. Cahill, W. E. Harwig, G. O. Lilly.

ELEVENTH CONVENTION, ATLANTA, GA., OCT. 15, 16, AND 17, 1901.

1.

Auxiliary Coaling Stations; Best Designs, Capacity, and Method of Handling Coal. Brought forward from 1900	W. A. McGonagle, G. W. Smith, E. Fisher, J. P. Snow, B. F. Bond, R. B. Tweedy.

2.

Roof Coverings, First Cost, Life, Efficiency, and Maintenance Expenses for Various Classes of Railroad Buildings	E. Fisher, R. H. Reed, J. S. Berry, J. P. Snow.

3.

Mail Cranes, First Cost, Efficiency and Maintenance of Various Styles in Use	A. S. Markley, F. Price, James Brady, G. W. Smith, D. W. Lum.

4.

Best Method of Protecting Low Overhead Structures Over Tracks from Gases and Blast of Locomotives.	G. W. Andrews, J. S. Lemond, C. M. Large, A. H. King, James T. Carpenter, E. H. R. Green, A. E. Killam.

5.

What has been the Experience in the Use of Concrete Under Bridge Bedplates and Turn-tables in Place of Pedestal Stones, and What is the Best Form and Material for Bedplates Under Various Styles of Iron Bridges?	W. A. Rogers, Frank W. Tanner, George J. Bishop, J. H. Markley, A. McNab, George E. Hanks.

6.

Best Design and Recent Practice in Building Railroad Track Pile Driver	T. M. Strain, A. W. Merrick, Chas. C. Mallard, A. B. Manning, W. M. Noon, W. T. Powell.

7.

Best Material and Designs for Roundhouse Pits, Including Drainage and Rail Fastings	Arthur Montzheimer, E. M. Gilchrist, J. W. Taylor, James Stannard, Onward Bates.

8.

Best Materials for Wearing Surface of Roadway of Highway Bridge Floors	W. O. Eggleston, B. F. Peckering, A. B. Sheldon, C. P. Austin, Joseph M. Staten, O. J. Travis.

TWELFTH CONVENTION, MINNEAPOLIS, MINN., OCT. 21 TO 23, 1902.

1.

Best False Work for Rocky Bottom in Rapid Currents Where Piles Cannot be Driven.................	John P. Canty, H. H. Eggleston, O. D. Killebrew, F. F. Lloyd, A. C. Macy, J. E. Greiner.

2.

Should Ties of Bridges be Gained so as to Leave Rail Without Camber, or Should Only a Portion of Camber Be Taken Out?.............................	R. H. Reid, Onward Bates, H. D. Cleaveland, Henry Goldmark, J. E. Johnson, G. W. McGehee.

3.

In Case One Arm of an Important Metal Drawbridge Over a Deep Stream Should be Wrecked, What is the Most Expeditious Way to Restore Railway and Water Traffic?...	John D. Isaacs, F. E. Schall, Geo. C. Nutting, W. M. Noon, A. McNab, Geo. W. Andrews.

4.

What is the Best Form of Traveler to Use in Erecting Steel Railway Bridges of Spans up to Two Hundred Feet?...	G. W. Smith, O. J. Travis, J. P. Snow, C. W. Kelley, Joseph M. Staten, F. W. Tanner.

5

Best Method of Protecting Solid Steel Floors of Bridges..	A. O. Cunningham, Geo. F. Powers, D. W. Lum, Albert C. Keith, C. P. Austin, F. E. Schall.

6.

Best Plans for Small Tool Houses, Including Switchmen's and Car Repairers' Shanties, and Section, Tool, and Hand-car Houses..........................	J. B. Sheldon, H. E. Holmes, W. E. Bell, Geo. Mitchell, Ed. Gagnon, C. R. Walton.

7.

Best Practical Sanitary Arrangements for Small Stations Where There Are no Water or Sewer Systems	J. H. Markley, F. J. Leavitt, Geo. J. Patterson, E. B. Ashby, T. J. Darracott, A. W. Merrick.

8.

Best Method of Making Annual Inspection of Bridges and Culverts, and Form of Report to be Made......	Walter G. Berg, J. A. Dodson, C. F. Loweth, Arthur Montzheimer, A. Zimmerman, A. Shane. I. O. Walker.

9.

Water Filters, or Other Methods of Purifying Water for Engine Use.....................	R. C. Sattley, J. E. Greiner, Ed. M. Gilchrist, Geo. E. Hanks, A. B. Manning, James Rogers.

10.

Best Method of Storing Fuel Oil, With Appliances for Supplying Locomotives, Including Plan of Water Stations, Showing Relative Arrangements of Fuel and Water Supply............................	C. C. Mallard, J. S. Berry, Geo. J. Bishop, William Carmichael, W. M. Clark, I. W. Evans, E. Fisher.

11.

What Has Been the Experience in the Use of Concrete Under Bridge Bed-plates and Turn-tables in Place of Pedestal Stones, and What is the Best Form and Material for Bed-plates Under Various Styles of Iron Bridges.........	Walter A. Rogers, A. Minster, L. F. Goodale, E. H. R. Green, J. C. Hain, E. P. Hawkins.

THIRTEENTH CONVENTION, QUEBEC, CANADA, OCT. 20 TO 22, 1903

1.

What is the Best Form of Traveler to Use in Erecting Steel Railway Bridges of Spans up to 200 Feet..	G. W. Smith, Moses Burpee, Geo. J. Bishop, A. O. Cunningham, J. C. Hain, I. F. Stern.

2.

What Has Been the Experience in Use of Concrete Under Bridge Bed-plates and Turn-tables in Place of Pedestal Stones, and What is the Best Form and Material for Bed-plates Under Various Styles of Iron Bridges (Continued from 1902)..................	C. F. Loweth, T. M. Strain, J. E. Johnson, A. Minster, D. W. Lum, J. P. Snow.

3.

Best Methods of Caring for Trestles While Being Filled....	A. H. King, J. B. Sheldon, H. D. Cleaveland, A. J. Hart, F. Ingalls, J. S. Lemond.

4.

Best Forms of Construction for Engine Houses.	A. W. Merrick, L. H. Wheaton, R. L. Heflin, C. W. Kelley, C. C. Mallard, A. B. Manning.

5.

Best Methods of Filling Ice Houses and Conveying Ice to Refrigerator Cars..............................	J. T. Carpenter, F. L. Burrell, John P. Canty, A. McNab, C. M. Large, G. Larson.

6.

Best Methods of Filling Track Water Tanks Automatically..	E. B. Ashby, Willard Beaham, C. H. Miller, Thomas S. Leake, F. E. Schall, L. F. Price.

7.

Steam Hammers Versus Drop Hammers for Pile-drivers	O. J. Travis, R. H. Reid, N. H. LaFountain, Frank J. Leavitt, G. O. Lilly, H. Bettinghouse.

8.

Best Form of Construction for Docks and Wharves	John D. Isaacs, W. A. McGonagle, Henry Goldmark, G. J. Klump, R. B. Tweedy, G. F. Powers.

9.

Best Record Forms for Buildings, Water Tanks, etc.	B. J. Sweatt, B. F. Pickering, A. Shane, I. O. Walker, J. F. White, William E. Harwig.

10.

Best Freight and Roundhouse Doors, and Fittings for the Same	John I. Banks, James McIntyre, R. K. Ross, Ed. Gilchrist, George W. Welker.

11.

Best Methods for Preserving Timber and Piles in Structures	Wm. F. Steffens, John D. Isaacs, Geo. A. Mountain, E. Loughery, C. C. Witt, B. F. Bond.

12.

Best Methods of Protecting Low Overhead Structures Over Tracks from Gases and Blast of Locomotives	B. W. Guppy, Grosvenor Aldrich, F. F. Lloyd, Robert J. Bruce, Wm. M. Clark, J. S. Berry.

FOURTEENTH CONVENTION, CHICAGO, ILL., OCTOBER 18 TO 20, 1904.

1.

Construction and Maintenance of Docks and Wharves.	H. Rettinghouse, W. A. McGonagle, A. A. Page, J. S. Browne. W. M. Noon, L. J. Anderson, L. D. Smith.

2.

Relative Value of Concrete and Timber Piles...........	W. H. Finley, J. C. Hain, W. A. Rogers, D. W. Lum, W. S. Dawley, L. F. Goodale.

3.

Concrete Building Construction, Including Platforms.	C. W. Richey, A. O. Cunningham, C. F. Loweth, G. A. Wright, F. P. Gutelius.

4.

Anchors for Plows and Derricks	R. J. Arey, A. J. Ross, E. Loughery, M. Bishop.

5.

Methods of Repairing Roofs of Various Kinds..........	J. N. Penwell, A. W. Merrick, G. C. Larson, H. W. Phillips, C. F. Flint, Floyd Ingram.

6.

Methods of Watering Stock in Transit..................	J. O. Thorn, B. J. Sweatt, F. O. Draper, F. Ingalls, F. L. Park.

7.

Protection of Water Tanks and Water Pipes from Action of Frost..	J. P. Canty, J. Parks, A. Findley, F. L. Burrell, K. J. C. Zinck.

8.

Recent Practice in Coffer Dam Work....................	W. F. Steffens, F. E. Schall, G. J. Klumpp, R. H. Reid, Wm. Kleefeld, Jr.

STANDING COMMITTEES.—FOURTEENTH CONVENTION.

1.

Pile and Frame Trestle Bridges............................ F. S. Edinger, W. M. Clark, I. F. Stern, W. E. Alexander, J. C. Taylor.

2.

Steel Bridges.. H. H. Eggleston, J. P. Snow, C. H. Cartlidge, H. M. Trippe, J. W. Lantry.

3.

Buildings.. E. Du Bois Brown, W. A. Pettis, W. C. Halsey, T. S. Leake.

4.

Docks and Wharves.. R. Angst, W. J. Mellor, John I. Banks, K. S. Hull, A. McDonald.

5.

Water Supply... B. M. Hudson, F. J. Leavitt, D. C. Zook, Charles Carr, J. H. Howe.

6.

Fire Protection.. Geo. W. Andrews, R. A. Nickerson, Wm. H. Keen, H. A. Horning.

7.

Fences, Crossings and Cattle Guards........................ C. S. Corrigan, C. F. King, J. S. Berry, Walter Hurst, Burton Marye.

8.

Preservatives for Wood and Metals.......................... F. D. Beal, J. F. Parker, E. Fisher, J. C. Beye, C. A. Thanheiser.

9.

Coaling Stations and Cinder Pits........................... W. B. Causey, R. M. Drake, J. W. McCormack, Willard Beaham.

10.

Records and Accounts....................................... H. M. Henson, R. C. Sattley, Ed. Gagnon, E. R. Floren.

FIFTEENTH CONVENTION, PITTSBURG, PA., OCTOBER 17 TO 19, 1905.

1.

Concrete Bridges, Arches and Subways..................	N. H. LaFountain, R. H. Reid, G. E. Hanks, A. S. Markley, H. D. Cleaveland, M. Burpee.

2.

Experience and Use of Concrete and Timber Piles.....	W. H. Finley, E. N. Layfield, W. S. Dawley, L. D. Smith.

3.

Concrete Building Construction..........................	C. W. Richey, W. W. Perry, Charles Carr, R. P. Mills, W. B. Yearance, R. L. Heflin.

4.

Method of Watering Stock in Transit....................	J. N. Penwell, U. A. Horn, M. R. Williams, C. F. King, G. F. Powers, J. C. Taylor.

5.

Recent Practice in Coffer Dam Work.....................	W. F. Steffens, G. Aldrich, W. A. Fort, E. P. Hawkins.

6.

Modern Coaling Stations and Cinder Pits................	J. S. Browne, F. B. Scheetz, D. W. Lum, G. H. Soles, F. P. Gutelius.

7.

Bumping Blocks for Passenger and Freight Use.......	A. E. Killam, Thos. S. Leake, F. L. Burrell, J. M. Staten, A. B. Hubbard.

COMMITTEES ON STANDING SUBJECTS.—FIFTEENTH CONVENTION.

1.

Pile and Frame Trestle Bridges	J. P. Canty, K. S. Hull, J. E. Johnson, W. O. Eggleston, H. F. Morrill.

2.

Steel Bridges	A. O. Cunningham, W. H. Wilkinson, J. P. Snow, W. M. Kleefeld, F. E. Schall.

3.

Buildings	W. B. Causey, F. Ingram, Walter Hurst, J. M. Caldwell.

4.

Water Supply	B. M. Hudson, H. Rettinghouse, M. Riney. J. L. Talbott, M. Bishop.

5.

Fire Protection	Geo. W. Andrews, R. A. Nickerson, W. H. Keene, D. C. Zook.

6.

Fences, Road Crossings and Cattle Guards	A. Findley, J. Hartley, A. McDonald, Geo. J. Patterson, M. F. Tucker.

7.

Preservatives for Wood and Metals	F. D. Beal, R. J. Arey, H. Small, W. A. McGonagle.

8.

Records and Accounts	R. C. Sattley, J. S. Lemond, James Stannard, J. C. Beye.

CONSTITUTION.

ARTICLE I.

NAME.

SECTION 1. This Association is known as the "Association of Railway Superintendents of Bridges and Buildings."

ARTICLE II.

OBJECT.

SECTION 1. The object of this Association shall be the mutual advancement of its members, by the acquirement of more perfect knowledge in the construction, maintenance, and repair of railroad bridges and buildings, as well as all other matters entrusted to the care of superintendents of bridges and buildings, by common discussion, interchange of ideas, reports, and investigations of its members.

ARTICLE III.

MEMBERSHIP.

SECTION 1. Any person at the head of a bridge and building department on any railroad, or a division or subdivision, and to include assistant superintendent and general foreman of any railroad, shall be eligible to membership in this Association upon application to the secretary and the payment of $3.00 membership fee and $2.00 for one year's dues, membership to continue until written resignation is received by the secretary, unless member has been previously expelled.

SEC. 2. Any member guilty of dishonorable conduct, or conduct unbecoming a railroad official and member of this Association, or who shall refuse to obey the chairman, or rules of this Association, may be expelled by a two-thirds vote of the members present.

SEC. 3. Any member elected a Life Member of this Association, shall have all of the privileges of an active member, but shall not be required to pay annual dues.

ARTICLE IV.

OFFICERS.

SECTION 1. The officers of this Association shall be a president, four vice-presidents, a secretary, a treasurer, and six executive members. The executive members, together with the president, secretary, and treasurer, shall constitute the Executive Committee.

All Past-Presidents of this Association, who continue to be members, shall be entitled to be present at all meetings of the Executive Committee, of which meetings they shall receive due notice, and be permitted to discuss all questions coming before the Executive Committee and to aid said committee by their advice and counsel; but, said Past-Presidents shall not have a right to vote, nor shall their presence be requisite in order to constitute a quorum.

ARTICLE V.

DUTIES OF OFFICERS.

SECTION 1. The duties of officers shall be such as prescribed by by-laws, as pertain to officers of like character, general, or may be assigned them by the Executive Committee.

ARTICLE VI.

EXECUTIVE COMMITTEE.

SECTION 1. The Executive Committee shall exercise a general supervision over the financial and other interests of the Association, assess the amount of annual and other dues, call, prepare for, and conduct general or special meetings, make all necessary purchases and contracts required to conduct the general business of the Association, but shall not have power to render the Association liable for any debt beyond the amount then in the treasurer's hands not subject to other prior liabilities. All appropriations for special purposes must be acted upon at a regular meeting of the Association.

SEC. 2. The Executive Committee shall report the proceedings of its meetings, making such reports accessible to members; it shall publish the proceedings of all meetings of the Association, subject to the approval of the Association.

SEC. 3. Two-thirds of the members of the Executive Committee may call special meetings, sixty days' notice being given members by mail.

SEC. 4. Five members of the Executive Committee shall constitute a quorum for the transaction of business.

ARTICLE VII.

ELECTION OF OFFICERS AND TENURE OF OFFICE.

SECTION 1. The officers, excepting as otherwise provided, shall be elected at the regular meeting of the Association, held on third Tuesday in October of each year, and the election shall not be postponed except by unanimous consent.

PRESIDENT AND TREASURER.

SEC. 2. The president and treasurer shall be elected by ballot by a majority of votes cast, and shall hold office for one year, or until successors are elected.

VICE-PRESIDENTS AND EXECUTIVE MEMBERS.

SEC. 3. The vice-presidents shall hold office for one year and executive members for two years, four vice-presidents, and three executive members to be elected each year; provided, however, that three of the executive members be appointed by the president at the adoption of this constitution. All officers herein named to hold office until successors are chosen at next annual meeting.

SEC. 4. In the election of vice-presidents, each one shall be elected by a majority vote. Executive members will be elected in the same way, all voting to be by written ballots.

SECRETARY.

SEC. 5. A secretary shall be elected by a majority of the votes of the members present at the annual meeting. The term of office of the secretary shall be for one year, unless terminated sooner by action of the Executive Committee, two-thirds of whom may remove the secretary at any time. His compensation shall be fixed by a majority of the Executive Committee. The secretary shall also be secretary of the Executive Committee.

TREASURER.

SEC. 6. The treasurer shall be required to give bond in an amount to be fixed by the majority of the Executive Committee.

ARTICLE VIII.

COMMITTEES.

SECTION 1. At the first session of the annual meeting the president shall appoint a committee of three members, not then officers of the Association, who shall send names of nominees for officers of the Association for the ensuing year to the secretary, before the election of officers is in order, and the names shall be announced as soon as received. The election shall not be held until the day after announcement, except by unanimous consent. Nothing in this section shall be construed to prevent any members from making nominations.

AUDITING COMMITTEE.

SEC. 2. At the first session of each annual meeting there shall be appointed by the president an auditing committee of three members, not officers of the Association, whose duty it shall be to examine the accounts and vouchers of the treasurer and certify as to the correctness of his accounts. Acceptance of this committee's report will be regarded as the discharge of the committee.

COMMITTEES ON SUBJECTS FOR DISCUSSION.

SEC. 3. At the annual meeting there shall be appointed by the president a committee, whose duty it shall be to prepare and report subjects for discussion and investigation at the next annual meeting. If subjects are approved by the Association, the presi-

dent shall appoint a committee to report on them. It shall be the duty of the committee to receive from members questions for discussion during the time set apart for that purpose. This committee shall be the judge of whether such questions are suitable ones for discussion, and if so, report them to the Association.

COMMITTEES ON INVESTIGATION.

SEC. 4. When the committee on subjects has reported and the Association approved of the same, the president shall appoint special committees to investigate and report on said subjects and he may appoint a special committee to investigate and report on any subject which a majority of members present may approve of.

ARTICLE IX.

ANNUAL DUES.

SECTION 1. Every member shall pay to the treasurer three dollars membership fee, and shall also pay two dollars per year in advance to defray the necessary expenses of the Association. No member being one year in arrears for dues will be entitled to vote at any election, and any member one year in arrears may be stricken from the list of members at the discretion of the Executive Committee.

ARTICLE X.

AMENDMENTS.

SECTION 1. This constitution may be amended at any regular meeting by a two-thirds vote of members present, provided that a written notice of the proposed amendment has been given at least ninety days previous to said regular meeting.

BY-LAWS.

TIME OF MEETING.

1. The regular meeting of this Association shall be held annually on the third Tuesday in October.

HOUR OF MEETING.

2. The regular hour of meeting shall be at 10 o'clock a. m.

PLACE OF MEETING.

3. The cities or places for holding the annual convention may be proposed at any regular meeting of the Association before the final adjournment. The places proposed shall be submitted to a ballot vote of the members of the Association, the city or place receiving a majority of all the votes cast to be declared the place of the next annual meeting; but if no place received a majority of all votes, then the place receiving the lowest number of votes shall be dropped on each subsequent ballot until a place is chosen.

QUORUM.

4. At the regular meeting of the Association, fifteen or more members shall constitute a quorum.

ORDER OF BUSINESS.

5. 1st—Calling of roll.
2d—Reading minutes of last meeting.
3d—Admission of new members.
4th—President's address.
5th—Reports of secretary and treasurer.
6th—Payment of annual dues.
7th—Appointment of committees.
8th—Reports of committees.
9th—Unfinished business.
10th—New business.
11th—Reading and discussion of questions propounded by members.
12th—Miscellaneous business.
13th—Election of officers.
14th—Adjournment.

DUTIES OF OFFICERS.

6. It shall be the duty of the president to call the meeting to order at the appointed time; to preside at all meetings; to announce the business before the Association, and to decide all questions of order and sign all orders drawn on the treasurer.

7. It shall be the duty of the vice-presidents, in the absence of the president, to preside at all meetings of the Association, in their order named.

8. It shall be the duty of the secretary to keep a correct record of proceedings of all meetings of this Association; to keep correct all accounts between this Association and its members; collect all moneys due the Association, and pay the same over to the treasurer and take his receipt therefor, and to perform such other duties as the Association may require.

9. It shall be the duty of the treasurer to receive and receipt to the secretary for all moneys received from him, and pay all orders authorized by the Association.

DECISIONS.

10. The votes of a majority of members present shall decide any question, motion, or resolution which shall be brought before the Association, unless otherwise provided.

DISCUSSIONS.

11. All discussions shall be governed by Roberts' Rules of Order.

DIRECTORY OF MEMBERS.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.

OCTOBER, 1905.

A

ALDRICH, GROSVENOR, N. Y., N. H. & H. R. R., Readville, Mass.

ALEXANDER, W. E., Bangor & Aroostook Railroad, Houlton, Me.

AMOS, ALEXANDER, Minn., St. P. & S. Ste. M. Ry., Minneapolis, Minn.

ANDERSON, J. W., Cin., Hamilton & Dayton Ry., Chillicothe, Ohio.

ANDERSON, L. J., C. & N. W. Ry., Escanaba, Mich.

ANDREWS, GEO. W., Asst. Engr. M. of W., B. & O. R. R., Mt. Royal Station, Baltimore, Md.

ANDREWS, O. H., St. Jo. & G. I. Ry., St. Joseph, Mo.

ANGST, R., Chief Engr., Duluth & Iron Range R. R., Duluth, Minn.

AREY, RALPH J., Asst. Engr., A., T. & S. F. Ry. (Coast Lines), Williams, Ariz.

ASHBY, E. B., Engr. M. of W., L. V. R. R., So. Bethlehem, Pa.

AUSTIN, CYRUS P., Boston & Maine R. R., Medford, Mass.

B

BAILEY, S. D., Michigan Central R. R., Detroit, Mich.

BAINBRIDGE, F. H., C. & N. W. Ry., Chicago, Ill.

BALL, EDGAR E., Asst. Engr., A., T. & S. F. Ry. (Coast Lines), Williams, Ariz.

BANKS, JOHN I., Tide Water R. R., 913 12th St., Norfolk, Va.

BARRETT, JOHN E., Supt. Track and B. & B., L. & H. R. Ry., Warwick, N. Y.

BASSETT, H. W., Pacific Coast Co., Seattle, Wash.

BATES, ONWARD, C. E., Ellsworth Building, 355 Dearborn St., Chicago, Ill.

BATTEY, CHARLES C., Boston & Maine R. R., Concord, N. H.

Beahan, Willard, L. S. & M. S. Ry., Cleveland, Ohio.

Beal, F. D., Southern Pacific Co., West Oakland, Cal.

Bell, W. E., Plant System, Thomasville, Ga.

Bender, H., Wis. Cent. Ry., Fond du Lac, Wis.

Berg, Walter G., Chief Engr., Lehigh Valley R. R., 261 West 52d St., New York City.

Berry, J. S., St. Louis Southwestern Ry., Tyler, Texas.

Berry, William, San Antonio & Aransas Pass Ry., Yoakum, Tex.

Beye, John C., Res. Engr., Union Pacific R. R., Cor. 12th & Liberty Sts., Kansas City, Mo.

Bishop, George J., G. T. Ry., Durand, Mich.

Bishop, McClellan, C. R. I. & P. Ry., Okla. Div., Chickasha, I. T.

Biss, C. H., Engr., New Zealand Govt. Rys., Auckland, New Zealand.

Blake, Alex. C., Wabash R. R., Moberly, Mo.

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*Information of his death received after Convention adjourned.

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Name of Road and Membership.	Members.	Mileage.
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J. W. Reagan, Farmington, N. M.		
Atchison, Topeka & Santa Fé Railway	6	5,031
F. M. Clough, San Marcial, N. M.		
J. D. Gilbert, Topeka, Kan.		
E. A. McCann, Wellington, Kan.		
John L. Talbott, Pueblo, Col.		
J. M. Wells, Chillicothe, Ill.		
M. R. Williams, Las Vegas, N. M.		
Atchison, Topeka & Santa Fé Railway (Coast Lines)	3	1,980
R. J. Arey, Williams, Ariz.		
E. E. Ball, Williams, Ariz.		
D. A. Shope, Winslow, Ariz.		
Atlanta & West Point Railroad, and Western Railway of Alabama	1	225
O. T. Nelson, Montgomery, Ala.		
Atlantic Coast Line (Plant System) Railroad.	1	4,085
W. E. Bell, Thomasville, Ga.		
Baltimore & Ohio Railroad	8	4,410
G. W. Andrews, Baltimore, Md.		
W. M. Clark, Warren, O.		
William Graham, Baltimore, Md.		
J. E. Greiner, Baltimore, Md.		
V. K. Hendricks, Baltimore, Md.		
J. T. McIlwain, Akron, O.		
W. T. Schultz, Zanesville, Ohio.		
E. C. Zinsmeister, Zanesville, O.		
Bangor & Aroostook Railroad	2	413
W. E. Alexander, Houlton, Me.		
M. Burpee, Houlton, Me.		

	Members.	Mileage.
Barclay Railroad	1	14
C. H. Davis, New York City.		
Bessemer & Lake Erie Railroad	1	216
H. D. Cleaveland, Greenville, Pa.		
Boston & Maine Railroad	13	2,287
Cyrus P. Austin, Medford, Mass.		
C. C. Battey, Concord, N. H.		
J. P. Canty, Fitchburg, Mass.		
Andrew B. Hubbard, Boston, Mass.		
F. J. Leavitt, Sanbornville, N. H.		
William A. Lydston, Salem, Mass.		
Albert Mountfort, Nashua, N. H.		
A. A. Page, Boston, Mass.		
S. F. Patterson, Concord, N. H.		
B. F. Pickering, Sanbornville, N. H.		
Fred C. Rand, Boston, Mass.		
J. P. Snow, Boston, Mass.		
E. C. Spaulding, St. Johnsbury, Vt.		
Buffalo, Rochester & Pittsburg Railway	2	475
D. J. Carson, Du Bois, Pa.		
E. J. Govern, Rochester, N. Y.		
Canada Atlantic Railway	1	468
George A. Mountain, Ottawa, Ont.		
Canadian Pacific Railway	5	9,425
Henry Goldmark, Montreal, P. Q.		
F. P. Gutelius, Montreal, P. Q.		
C. N. Monsarrat, Montreal, P. Q.		
P. B. Motley, Montreal, P. Q.		
W. F. Tye, Montreal, P. Q.		
Central of Georgia Railway	2	1,878
H. C. McKee, Macon, Ga.		
M. F. Tucker, Americus, Ga.		
Central Railroad of New Jersey	1	641
A. L. Bowman, Jersey City, N. J.		
Central Vermont Railway	3	531
C. F. Flint, St. Albans, Vt.		
H. E. Holmes, New London, Conn.		
G. J. Patterson, Waterbury, Vt.		

	Members.	Mileage.
Chesapeake & Ohio Railway	2	1,707
J. M. Staten, Richmond, Va.		
C. W. Vandegrift, Ronceverte, W. Va.		
Chicago & Alton Railway	2	970
W. B. Causey, Bloomington, Ill.		
H. H. Eggleston, Bloomington, Ill.		
Chicago & Eastern Illinois Railroad	4	823
W. S. Dawley, Chicago, Ill.		
A. S. Markley, Danville, Ill.		
H. D. Perkins, Villa Grove, Ill.		
G. A. Wright, Danville, Ill.		
Chicago & North Western Railway	30	7,363
L. J. Anderson, Escanaba, Mich.		
F. H. Bainbridge, Chicago, Ill.		
F. L. Burrell, Fremont, Neb.		
Henry Crane (retired), Janesville, Wis.		
William Curtin, Boone, Ia.		
H. W. Fletcher (retired), Allegheny, Pa.		
M. J. Flynn, Chicago, Ill.		
W. C. Halsey, Eagle Grove, Ia.		
John Hunciker, Chicago, Ill.		
Lee Jutton, Chicago, Ill.		
C. F. King, Norfolk, Neb.		
C. A. Lichty, Fond du Lac, Wis.		
George Loughnane, Mason City, Ia.		
A. W. Merrick, Boone, Ia.		
H. P. Morrill, Madison, Wis.		
R. A. Nickerson, Chicago, Ill.		
E. F. Reynolds, Antigo, Wis.		
M. Riney, Baraboo, Wis.		
J. S. Robinson, Chicago, Ill.		
D. Rounseville, Kaukauna, Wis.		
R. C. Sattley, Winona, Minn.		
I. F. Stern, Chicago, Ill.		
F. C. Stimson, Baraboo, Wis.		
B. J. Sweatt, Boone, Ia.		
W. J. Towne, Chicago, Ill.		
H. M. Trippe, Chicago, Ill.		
H. A. Walden, Boone, Ia.		
W. D. Walden (retired), Clinton, Ia.		
A. E. Winter, Fond du Lac, Wis.		
C. C. Witt, Chicago, Ill.		

	Members.	Mileage.
Chicago, Burlington & Quincy Railway, and K. C., St. Jo. & C. B. Railway	6	8,562
C. H. Cartlidge, Chicago, Ill.		
E. M. Gilchrist, Centerville, Ia.		
L. F. Goodale, St. Louis, Mo.		
W. Hurst, St. Joseph, Mo.		
Walter T. Krausch, Chicago, Ill.		
J. O. Thorn, Beardstown, Ill.		
Chicago Great Western Railway	1	1,321
A. Munster, St. Paul, Minn.		
Chicago, Indianapolis & Louisville Railway	1	536
J. M. Caldwell, Lafayette, Ind.		
Chicago, Milwaukee & St. Paul Railway	5	7,080
A. J. Hart, Minneapolis, Minn.		
N. H. La Fountain, Chicago, Ill.		
C. F. Loweth, Chicago, Ill.		
W. E. Smith, Chicago, Ill.		
A. Yappen, Milwaukee, Wis.		
Chicago, Rock Island & Pacific Railway	4	6,704
McClellan Bishop, Chickasha, I. T.		
E. R. Floren, Fairbury, Neb.		
F. L. Park, Topeka, Kan.		
K. J. C. Zinck, Des Moines, Ia.		
Chicago, St. Paul, Minneapolis & Omaha Railway	3	1,686
G. Larson, Itasca, Wis.		
J. W. McCormack, Altoona, Wis.		
John Schwartz, Emerson, Neb.		
Chicago Terminal Transfer Railroad	1	259
E. N. Layfield, Chicago, Ill.		
Cincinnati, Hamilton & Dayton Railway	2	1,025
J. W. Anderson, Chillicothe, O.		
I. F. White, Dayton, O.		
Cincinnati Northern Railroad	1	236
J. M. Wilkinson, Van Wert, O.		
Coast Railway of Nova Scotia, The	1	
L. H. Wheaton, Yarmouth, N. S.		
Colorado & Southern Railway	1	1,121
W. T. Powell, Denver, Col.		

	Members.	Mileage
Denver, Enid & Gulf Railroad................	1	120
H. M. Henson, Enid, Okla.		
Duluth & Iron Range Railroad...............	1	161
R. Angst, Duluth, Minn.		
Duluth, Missabe & Northern Railway.........	1	153
W. A. McGonagle, Duluth, Minn.		
Duluth, South Shore & Atlantic Railway......	1	576
W. M. Noon, Marquette, Mich.		
Elgin, Joliet & Eastern Railway, and Chicago, Lake Shore & Eastern Railway.............	2	386
A. Montzheimer, Joliet, Ill.		
G. F. Powers, Joliet, Ill.		
El Paso & Southwestern System..............	3	810
George C. Millet, El Paso, Tex.		
Bailey J. Mustain, El Paso, Tex.		
Sam Mustain, Alamogordo, N. M.		
Erie Railroad (and Chicago & Erie)..........	4	2,420
W. O. Eggleston, Huntington, Ind.		
Neil McLean, Huntington, Ind.		
J. F. Pelham, Avon, N. Y.		
W. H. Wilkinson, Elmira, N. Y.		
Fort Worth & Denver City Railway...........	2	453
J. M. Mann, Fort Worth, Tex.		
O. J. Travis, Fort Worth, Tex.		
Galveston, Harrisburg & San Antonio Railway	4	1,242
C. S. Corrigan, San Antonio, Tex.		
C. R. Morrill, El Paso, Tex.		
A. J. Ross, El Paso, Tex.		
H. Small, San Antonio, Tex.		
Galveston, Houston & Northern Railway, and Texas & New Orleans Railroad.............	2	496
A. McDonald, Houston, Tex.		
C. A. Thanheiser, Houston, Tex.		
Georgia Railroad	2	307
B. A. Guill, Camok, Ga.		
W. M. Robinson, Augusta, Ga.		
Grand Rapids & Indiana Railway.............	1	599
W. S. McKeel, Grand Rapids, Mich.		

	Members.	Mileage.
Grand Trunk Railway System................	7	4,177
G. J. Bishop, Durand, Mich.		
Ebenezer Brown, Allandale, Ont.		
A. Findley, Montreal, P. Q.		
J. D. Lacy, Durand, Mich.		
George A. Mitchell, Toronto, Ont.		
A. E. Patton, Montreal, P. Q.		
R. K. Ross, Ionia, Mich.		
Gulf, Colorado & Santa Fé Railway...........	4	1,434
S. F. Clapp, Temple, Tex.		
K. S. Hull, Beaumont, Tex.		
T. H. Morgan, Cleburne, Tex.		
L. D. Smith, Galveston, Tex.		
Halifax & Southwestern Railway.............	1	195
I. H. White, Bridgewater, N. S.		
Illinois Central Railroad.....................	7	4,374
F. O. Draper, Freeport Ill.		
T. J. Fullem, Chicago, Ill.		
Thomas S. Leake, Chicago, Ill.		
R. J. McKee, Clinton, Ill.		
William Reed, Jr., Fort Dodge, Ia.		
W. C. Waggoner, Princeton, Ky.		
E. F. Wise (retired), Waterloo, Ia.		
Illinois Southern Railway....................	1	135
G. O. Lilly, Sparta Ill.		
Intercolonial Railway	7	1,467
T. C. Burpee, Moncton, N. B.		
Hugh Jardine, Moncton, N. B.		
A. E. Killam, Moncton, N. B.		
H. I. McGrath, Moncton, N. B.		
W. B. McKenzie, Moncton, N. B.		
Thomas Sefton, Moncton, N. B.		
A. C. Selig, Moncton, N. B.		
Jacksonville & St. Louis Railway.............	1	121
B. F. Bond, Jacksonville, Ill.		
Kansas City, Clinton & Springfield Railway...	1	248
J. B. Brown, Clinton, Mo.		
Lake Erie & Western Railway................	1	719
J. N. Penwell, Tipton, Ind.		

	Members.	Mileage.
Lake Shore & Michigan Southern Railway.....	2	1,528
Willard Beahan, Cleveland, O.		
R. H. Reid, Cleveland, O.		
Lehigh & Hudson River Railway..............	1	91
J. E. Barrett, Warwick, N. Y.		
Lehigh Valley Railroad......................	6	1,393
E. B. Ashby, South Bethlehem, Pa.		
Walter G. Berg, New York City.		
W. E. Harwig, Easton, Pa.		
R. L. Heflin, Sayre, Pa.		
David A. Keefe, Athens, Pa.		
F. E. Schall, South Bethlehem, Pa.		
Long Island Railroad........................	1	392
J. H. Cummin, Jamaica, N. Y.		
Louisville & Nashville Railroad...............	1	4,020
Floyd Ingram, Erin, Tenn.		
Maine Central Railroad......................	1	821
P. N. Watson, Brunswick, Me.		
Michigan Central Railroad	5	1,770
S. D. Bailey, Detroit, Mich.		
Charles Carr, Jackson, Mich.		
Thomas Hall, St. Thomas, Ont.		
Henry A. Horning, Niles, Mich.		
J. T. Webster, St. Thomas, Ont.		
Minneapolis & St. Louis Railroad.............	1	823
Ed. Gagnon, Minneapolis, Minn.		
Minneapolis, St. Paul & Sault Ste. Marie Railway	2	1,829
A. Amos, Minneapolis, Minn.		
P. Swenson, Minneapolis, Minn.		
Missouri Pacific Railway System.............	8	6,237
E. Fisher, St. Louis, Mo.		
F. W. Hausgen, Pacific, Mo.		
U. A. Horn, Osawatomie, Kan.		
J. O. Potts, St. Louis, Mo.		
F. B. Scheetz, St. Louis, Mo.		
W. T. Schultz, St. Louis, Mo.		
F. W. Tanner, St. Louis, Mo.		
L. J. Wackerle, St. Louis, Mo.		

	Members.	Mileage.
Mobile & Ohio Railroad	2	912
E. P. Hawkins, Murphysboro, Ill.		
C. A. Pigford, Meridian, Miss.		
Mobile & Bay Shore Railway (see Mobile & Ohio).		
Nashville, Chattanooga & St. Louis Railway	1	1,200
I. O. Walker, Paducah, Ky.		
New South Wales Government Railways	1	3,138
James Fraser, Sydney, N. S. W.		
New York Central & Hudson River Railroad	6	2,881
William Kleefeld, Watertown, N. Y.		
G. J. Klumpp, Rochester, N. Y.		
J. F. Lantry, Weehawken, N. J.		
R. P. Mills, Mott Haven, N. Y.		
W. A. Pettis, Rochester, N. Y.		
H. C. Thompson, Weehawken, N. J.		
New York, Chicago & St. Louis Railroad	1	523
James Rogers, Fort Wayne, Ind.		
New York, New Haven & Hartford Railroad	9	2,037
Grosvenor Aldrich, Readville, Mass.		
J. S. Browne, Providence, R. I.		
H. K. Higgins, Dorchester, Mass.		
William H. Keene, Hartford, Conn.		
H. W. Phillips, South Braintree, Mass.		
L. H. Porter, Franklin, Mass.		
George T. Sampson, Boston, Mass.		
D. W. Sharpe, New London, Conn.		
J. B. Sheldon, Providence, R. I.		
New Zealand Government Railways	3	2,291
C. H. Biss, Auckland, New Zealand.		
James Burnett, Wellington, New Zealand.		
George C. Troup, Wellington, New Zealand.		
Northern Pacific Railway	6	5,305
James Hartley, Staples, Minn.		
N. F. Helmers, Staples, Minn.		
F. Ingalls, Jamestown, N. D.		
B. T. McIvers, St. Paul, Minn.		
J. C. Taylor, Glendive, Mont.		
Louis Yager, Minneapolis, Minn.		

	Members.	Mileage.
New Orleans Terminal Co..................	1	23
Frank G. Jonah, New Orleans, La.		
Oregon Short Line Railroad..................	1	1,266
A. H. King, Salt Lake City, Utah.		
Pacific Coast Co., The........................	1	143
H. W. Bassett, Seattle, Wash.		
Pennsylvania Lines West of Pittsburg........	6	2,712
Robert J. Bruce, Logansport, Ind.		
S. Geary, Cambridge, Ohio.		
C. M. Large, Jamestown, Pa.		
A. F. Miller, Chicago, Ill.		
D. G. Musser, Wellsville, Ohio.		
D. C. Zook, Fort Wayne, Ind.		
Pennsylvania Railroad	2	5,190
Robert McKibbon, Dravosburg, Pa.		
C. W. Richey, Pittsburg, Pa.		
Pere Marquette Railroad.....................	2	2,320
G. E. Hanks, Saginaw, Mich.		
A. McNab, Holland, Mich.		
Philadelphia & Reading Railway.............	2	1,475
John Foreman (retired), Pottstown, Pa.		
W. W. Perry, Williamsport, Pa.		
Pittsburg & Lake Erie Railroad...............	2	191
D. L. McKee, McKee's Rocks, Pa.		
G. H. Soles, Pittsburg, Pa.		
Portland & Rumford Falls Railway...........	1	68
C. S. Osgood, Rumford Falls, Me.		
Quebec & Lake St. John Railway.............	1	241
A. E. Doucet, Quebec, Que.		
Rutland Railroad	1	416
J. E. Johnson, Rutland, Vt.		
St. Joseph & Grand Island Railway............	1	313
O. H. Andrews, St. Joseph, Mo.		
St. Louis & San Francisco Railroad...........	1	5,086
Samuel Boutin, Cape Girardeau, Mo.		
St. Louis, Kansas City & Colorado Railroad...	1	262
B. M. Hudson, Union, Mo.		

	Members.	Mileage.
St. Louis Southwestern Railway	1	1,309
J. S. Berry, Tyler, Tex.		
San Antonio & Aransas Pass Railway	1	724
William Berry, Yoakum, Tex.		
Sonora Railway	1	265
J. S. Bright, Guaymas, Mex.		
South & Western Railway	1	154
William F. Steffens, Bristol, Va.-Tenn.		
Southern Railway	8	7,201
James T. Carpenter, Princeton, Ind.		
William A. Fort, Columbia, S. C.		
O. D. Killebrew, Columbia, S. C.		
J. S. Lemond, Atlanta, Ga.		
D. W. Lum, Washington, D. C.		
B. Marye, Richmond, Va.		
J. W. Morgan, Columbia, S. C.		
G. W. Welker, Alexandria, Va.		
Southern California Railway	1	499
J. F. Parker, San Bernardino, Cal.		
Southern Pacific Company	9	5,971
F. D. Beal, West Oakland, Cal.		
Frank V. Carman, West Oakland, Cal.		
R. M. Drake, San Francisco, Cal.		
F. S. Edinger, San Francisco, Cal.		
Thomas Humphreys, Bakersfield, Cal.		
F. W. Lloyd, Oakland Pier, Cal.		
W. J. Mellor, Algiers, La.		
George W. Rear, San Francisco, Cal.		
Daniel Robertson, West Oakland, Cal.		
Temiskaming & Northern Ontario Railway	1	113
W. B. Russell, North Bay, Ont.		
Texas & New Orleans Railroad, and Galveston, Houston & Northern Railway	1	496
A. McDonald, Houston, Tex.		
Texas & Pacific Railway	1	1,833
E. Loughery, Marshall, Tex.		
Texas Midland Railroad	1	125
E. H. R. Green, Terrell, Tex.		

	Members.	Mileage.
Tide Water Railway........................	1	100
John I. Banks.		
Toledo, Peoria & Western Railway............	1	248
J. H. Markley, Peoria, Ill.		
Toledo, St. Louis & Western Railroad.........	1	450
A. Shane, Frankfort, Ind.		
Union Pacific Railroad.......................	4	2,956
J. C. Beye, Kansas City, Mo.		
J. H. Howe, Omaha, Neb.		
J. L. Neff, Omaha, Neb.		
J. Parks, Denver, Col.		
Wabash Railroad	4	2,516
A. C. Blake, Moberly, Mo.		
A. O. Cunningham, St. Louis, Mo.		
William S. Danes, Peru, Ind.		
James Stannard, Moberly, Mo.		
Wellington & Manawata Railway (New Zealand)	1	84
Arthur Williams, Wellington, New Zealand.		
Western Australia Government Railways......	2	1,516
W. J. George, Perth, Western Australia.		
E. S. Hume, Fremantle, Western Australia.		
Wisconsin Central Railway...................	2	977
Henry Bender, Fond du Lac, Wis.		
H. Rettinghouse, Fond du Lac, Wis.		
Miscellaneous	22	
	313	176,634

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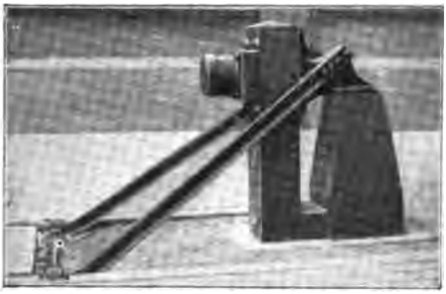
The Ellis Patent Bumping Posts

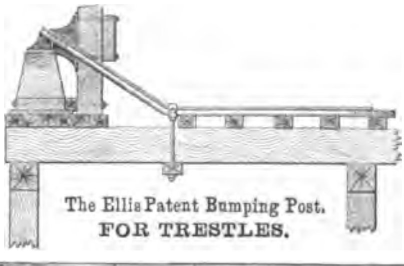
NOTED FOR SIMPLICITY, STRENGTH AND LASTING QUALITIES. NEAT IN APPEARANCE. OCCUPY LITTLE SPACE.

ADAPTED TO ALL POSITIONS. HIGHEST AWARD AT THE WORLD'S FAIR.



STANDARD PASSENGER POST.

STANDARD FREIGHT POST.

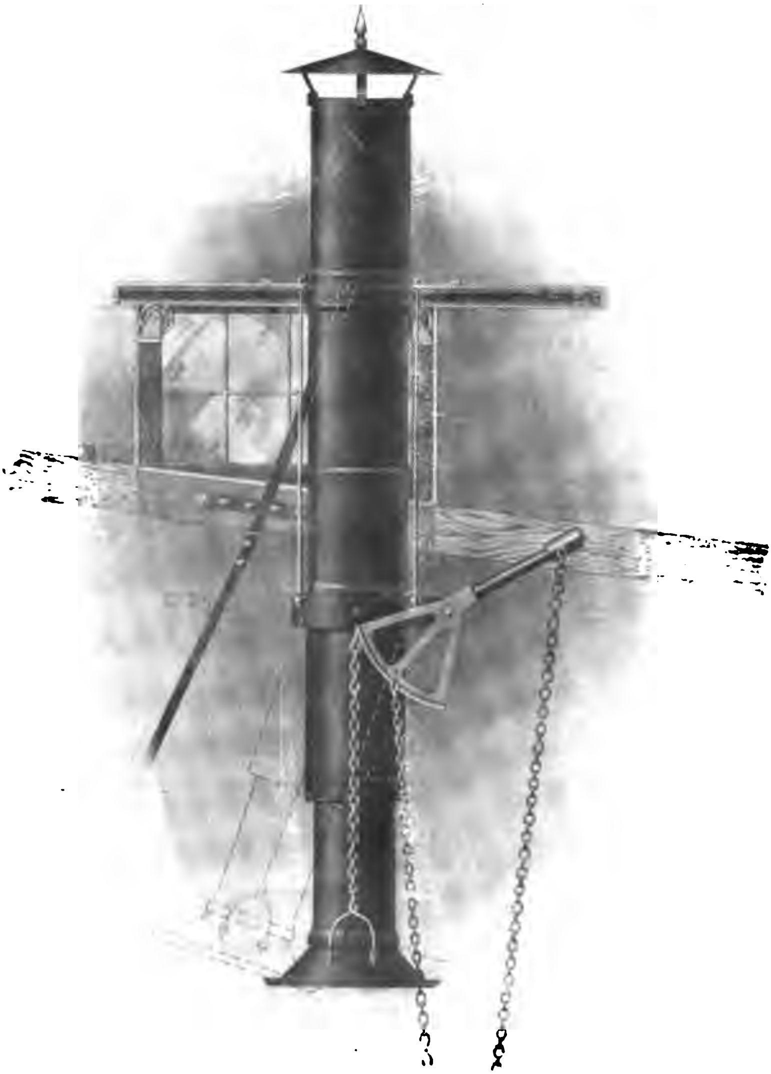


The Ellis Patent Bumping Post.
FOR TRESTLES.

A TEST.

SHIPPED COMPLETE WITH DIRECTIONS FOR ERECTING. WRITE FOR CIRCULARS AND PRICES.

GEORGE L. CHATFIELD, Agent, Chicago, Ill.



MONON TRESTLE, PAOLI, INDIANA.


1906

PROCEEDINGS

OF THE

Sixteenth Annual Convention

OF THE

Association of Railway Superintendents of Bridges and Buildings

HELD IN

BOSTON, MASS.

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1906

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John P. Canty . . . . . Second Vice-President
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H. Rettinghouse . . . . . Third Vice-President
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F. E. Schall . . . . . . Fourth Vice-President.
Lehigh Valley Railroad, South Bethlehem, Pa.

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Boston & Maine Railroad, Concord, N. H.

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Intercolonial Railway.

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C. W. Richey . . . . Pittsburg, Pa.
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Chicago & Alton Railroad.

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* Deceased.

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R. C. Sattley, C. & N. W. Ry., Winona, Minn.

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T. J. Fullem, Illinois Central R. R., Chicago, Ill.
M. Riney, C. & N. W. Ry., Baraboo, Wis.

III. Experience as to Expansion and Contraction of Concrete Walls, Either Reinforced or Plain Concrete.

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W. A. Rogers, Ellsworth Building, 355 Dearborn St., Chicago, Ill.
R. H. Reid, L. S. & M. S. Ry., Cleveland, Ohio.
P. J. O'Neil, L. S. & M. S. Ry., Adrian, Mich.

IV. Action of Sea Water on Concrete.

(a) Concrete Made in Air and Sunk into Sea Water.
(b) Concrete Deposited Direct into Sea Water.

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Geo. W. Andrews, B. & O. R. R., B. & O. Building, Baltimore, Md.
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A. F. Miller, Penn. Lines West of Pittsburg, Chicago, Ill.

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John L. Talbott, A., T. & S. F. Ry., Pueblo, Col.
W. T. Powell, C. & S. R. R., Denver, Col.

VII. Construction of Towers and Guides for Lights on Draw Bridges.

John N. Penwell, L. E. & W. Ry., Tipton, Ind., Chairman.
Floyd Ingram, L. & N. R. R., Erin, Tenn.
Geo. W. Rear, Southern Pacific Co., San Francisco, Cal.
G. J. Klumpp, N. Y. C. & H. R. R. R., Rochester N. Y.

VIII. Recent Experience in Protecting Steel Railroad Bridges Against the Action of Salt Brine from Refrigerator Cars.

R. P. Mills, N. Y. C. & H. R. R. R., Mott Haven, N. Y., Chairman.
A. Montzheimer, E. J. & E. Ry., Joliet, Ill.
Walter G. Berg, Lehigh Valley R. R., New York, N. Y.
F. O. Draper, Illinois Central R. R., Chicago, Ill.
Charles Carr, Michigan Central R. R., Jackson, Mich.

COMMITTEES ON STANDING SUBJECTS.

1. Pile and Frame Trestle Bridges.

W. E. Smith, C., M. & St. P. Ry., Chicago, Ill., Chairman.
J. S. Berry, St. L. S. W. Ry., Tyler, Tex.
John C. Beye, Union Pacific R. R., Kansas City, Mo.
E. R. Florin, C. R. I. & P. Ry., Fairbury, Neb.

2. Water Supply.

C. E. Thomas, Illinois Central R. R., Chicago, Ill., Chairman.
J. M. Caldwell, C. I. & L. R. R., LaFayette, Ind.
B. F. Bond, J. & St. L. Ry., Jacksonville, Ill.
A. C. Blake, Wabash R. R., Moberly, Mo.

3. Fire Protection.

Wm. C. Carmichael, C., R. I. & P. Ry., El Reno, Okla., Chairman.
D. A. Shope, A., T. & S. F. Ry., Winslow, Ariz.
A. Shane, T., St. L. & K. C. Ry., Frankfort, Ind.
S. F. Clapp, G. C. & S. F. Ry., Temple, Tex.

4. Fences, Road Crossings and Cattle Guards.

W. M. Noon, D. S. S. & A. Ry., Marquette, Mich., Chairman.
A. McNab, Pere Marquette R. R., Holland, Mich.
W. A. Fort, Southern Ry., Columbia, S. C.
F. W. Tanner, Mo. Pac. Ry., St. Louis, Mo.

5. Preservatives for Wood and Metal.

J. F. Parker, Southern California Ry., San Bernardino, Cal., Chairman.
R. J. Arey, A., T. & S. F. Ry., Williams, Ariz.
James Fraser, N. S. W. Gov't Ry's., Sydney, N. S. W.
J. S. Lemond, Southern Ry., Atlanta, Ga.
R. J. Bruce, Mo. Pac. Ry., St. Louis, Mo.

COMMITTEE ON SELECTION OF SUBJECTS.

F. E. Schall, Lehigh Valley R. R., South Bethlehem, Pa.
J. H. Cummin, Long Island R. R., Jamaica, N. Y.
Wm. M. Clark, B. & O. R. R., Youngstown, Ohio.

COMMITTEE ON APPLICATION FOR MEMBERSHIP.

C. A. Lichty, C. & N. W. Ry., Fond du Lac, Wis.
H. H. Eggleston, C. & A. Ry., Bloomington, Ill.

COMMITTEE ON ENTERTAINMENT.

A. H. King, Oregon Short Line R. R., Salt Lake City, Utah.
C. S. Thompson, D. & R. G. Ry., Salt Lake City, Utah.

COMMITTEE ON RELIEF.

A. Montzheimer, E. J. & E. Ry., Joliet, Ill.
J. P. Canty, B. & M. R. R., Fitchburg, Mass.
Alexander C. Blake, Wabash R. R., Moberly, Mo.

COMMITTEE ON MEMOIRS.

J. T. Carpenter, Southern Ry., Princeton, Ind.

COMMITTEE ON BADGES.

J. H. Cummin, Long Island R. R., Jamaica, N. Y.

Proceedings of the Sixteenth Annual Convention

OF THE

Association of Railway Superintendents of Bridges and Buildings

HELD IN BOSTON, MASS., OCTOBER 16, 17 AND 18, 1906

MORNING SESSION.

TUESDAY, October 16, 1906.

The convention was called to order by the president, Mr. J. B. Sheldon, at 10.15 o'clock a. m., Tuesday, October 16, 1906, in the Assembly Hall of the American House at Boston, Mass.

President.—Ladies and Gentlemen: The time is now at hand for opening our sixteenth annual convention, and we will follow our usual custom by commencing the session with prayer.

Mr. J. H. Cummin of the Long Island Railroad then opened the meeting with prayer.

President.—We have gathered here this morning in our sixteenth annual convention and for the first time we are meeting in a city of New England. In holding our convention in Boston we have come into the greatest business and railroad center within its borders and to a community in which the personal and business characteristics peculiar to New England can be studied at close range. We hope the impression made will be a pleasant and long remembered one. We have with us today a typical New England railroad and business man, one amply qualified to give words of greeting and welcome. It gives me great pleasure to introduce to you Mr. Lucius Tuttle, president of the Boston & Maine Railroad. (Applause.)

Mr. Tuttle.—Mr. Chairman, Ladies and Gentlemen: I answer the request that I offer a few words of welcome to your Association in this, its first meeting in New England, with the greatest pleasure. I am glad to see that you have brought with you a good representation of the "better half" of your organization, for I have found in dealing with men everywhere that the best are those who have the best wives; and I think that it is not only just, but wise, that when the opportunity comes to meet in a gathering of this kind, you should give your wives a share in the pleasures as well as in the business of your Association. I welcome you all to New England in the best part of its year—the month of October—which is New England's glory so far as climatic conditions go. You have, in its clear, bracing atmosphere, an opportunity to go about and observe interesting things without fatigue; and I trust that while you are here you will avail yourselves, during the recesses of your Association work, of the opportunities given to visit the many interesting places that lie in the City of Boston and its immediate suburbs. You probably know all about these places from reading the story of them; and I have no doubt that many of you who come from a distance know more about these interesting memorials of the country's history than we do, who live next door to them; and I am sure, if you will see Concord and Lexington, Bunker Hill, the old and new state houses, and the many other interesting memorials of that which has had to do with the making of the history of New England and of the whole country, you will find in that part of your visit much pleasure and instruction. For those who are interested in mechanical construction, a trip through our park system, with its splendid roadways and bridges, and its illustrations of what is possible in landscape gardening—the beautiful as well as the useful—the heritage that is being prepared for the generations that are to come after us, will furnish matters of special interest.

As to the work of your Association, I notice you have a number of most interesting topics for discussion, and I wish

to say, after having an experience covering almost half a century, that I believe nothing has accomplished more for the good of the transportation service than the assembling of this and kindred associations for the interchange of ideas and of knowledge. It is one of the things to be proud of, in the present day, that the instant a man of intelligence learns something new, or finds out something, that he believes will be for the general good of mankind at large, he does not attempt to conceal it, but is anxious to distribute this knowledge to others with the purpose of helping to bring good results to all. Through the association of railroad workers, this plan of disseminating information and of teaching each other, and of finding out what the others are doing, is, to my mind, worth many fold of what it takes of time and money to carry on this and similar associations. I think it is the duty of every member, no matter to what branch of the service he belongs, to attend this kind of meeting whenever the opportunity comes to do so; otherwise a man is apt to fall into the opinion that his way is the only way, and that everything that is not done his way is not perhaps done as well as it might be. There never was anything more misleading and harmful than this idea. No one man can have a monopoly of the best ideas: and no matter how good his ideas are, when he presents them for the consideration of other intelligent persons, they are broadened, enlarged and made useful in a way that could never become possible through his individual efforts. Therefore, the more intelligent railroad managers everywhere look upon associations of this kind as making possible better means, better growth, and better results in the whole public service of our railroads. In your branch of the service there has resulted a change for the better in the construction of buildings and bridges, and all of the things in your department essential to railroad operation.

Gentlemen, my duty is simply that of welcoming you to Boston; and to those of you who are familiar with the city and its environs, it will be easy to find what you want to

see; but those who are not so familiar may, perhaps, wander a good many miles through our crooked streets in reaching places only short distances away. But I am sure you will find in Boston a kindly welcome and the greatest courtesy on the part of its residents in assisting you to find whatever you are seeking, and that, when your convention is over, each will return home, feeling that you have been not only welcomed, but have been hospitably entertained here, and that, aside from the business profitableness of the meeting, you have had the good vacation and enjoyable time to which you are so fully entitled.

President.—Ladies and Gentlemen: You have heard the pleasing address of President Tuttle, and on behalf of our Association, I will ask Mr. J. H. Cummin to give us a few words in response to Mr. Tuttle's remarks.

Mr. Cummin.—President Tuttle, when I first received a copy of the program of this meeting from our secretary, in reading it over, I was very much pleased to see that you were to be with us here this morning, because I felt it was about time that we departed from the rut we had gotten into, in the past few years, where we have usually had some city official come to open our meeting, to welcome us and to extol the beauties of the city that we were visiting, and to tell us that if we would look upon the map we would find that every important railroad, centered or pointed towards that one spot, and to conclude with offering us the freedom of the city, and assuring us that if any of our members were arrested, that all we would have to do would be to send for the speaker and he would see that they were released at once. I am pleased to state that, to my knowledge, no member of this Association has had to take advantage of that offer. I wish to thank you, sir, in behalf of our Association and our guests: First, for your kindness and courtesy in laying aside the many cares and responsibilities of your position to be with us here this morning and to address us in the pleasing manner in which you have done; secondly, for the instructive words which you have spoken to us,

words that I am sure will be treasured in the minds of our members long after this meeting shall have passed into history; and last, but not least, for the example you have set in your own life, not only to us, but to railroad men throughout our land. Starting, as you did, sir, at the foot of the ladder, you have by a perseverence in every detail and a sincerity in every purpose, advanced step by step until you have arrived at the top, and become the head of one of the great railroad systems of our country. Thus proving in your own life the truth of that old saying, "There is always room at the top." I remember reading an article which stated that the *Boston Herald*, some time ago, sent out letters to the presidents of the different railroad systems, asking them to give the reason for their success in railroad life. Your answer, I believe, was brief, consisting of one word, "Work." And, sir, this we have tried to make the motto of this Association from its organization down to the present time. As you have stated, we gather here for the interchange of ideas, for the discussion of the different subjects that come before us, and thus be enabled to return to our homes better fortified in every way to perform the duties assigned to us, and I believe the records of our past proceedings will show that we have a right to feel a just pride in the work which has been accomplished. Our proceedings have been published in the technical journals, not only in this country but abroad, even in far off Australia. There is one thing about this Association that pleases me very much, and that is the fraternal spirit that has been shown by the members of this Association one towards the other, a thing that I have never seen equalled in any society of this kind of which I have had the honor to be a member, and we are also always pleased to have the ladies with us. They come with us and enjoy the trips to the various places which we visit, and I believe their influence has always been a benefit to us, both socially and morally. We sincerely thank you, sir, for your kind remarks and for the cordial welcome which you have extended to us.

Mr. Tuttle.—I wish to thank you for the hospitable reception given me, and I hope you will let me know if there is anything our company can do to add to your pleasure while you are in Boston. I regret that I have an engagement almost immediately on important matters, made some time before I knew of this meeting, and I must ask you to excuse me now.

President.—The next order of business is calling the roll, but we will omit this and I would like to ask all present to register their names and addresses on the registration cards, which we have provided here for this purpose, so we can have a complete list of all in attendance.

MEMBERS PRESENT.

Aldrich, Grosvenor, N. Y., N. H. & H. R. R., Readville, Mass.
Alexander, W. E., Bangor & Aroostook Railroad, Houlton, Me.
Austin, Cyrus P., Boston & Maine R. R., Medford, Mass.
Brown, Edward D. B., Fairbanks, Morse & Co., Chicago, Ill.
Brown, J. B., K. C., C. & S. Ry., Clinton, Mo.
Browne, J. S., N. Y., N. H. & H. R. R., Providence, R. I.
Burpee, Moses, Chief Engr., Bangor & Aroostook R. R., Houlton, Me.
Canty, John P., Fitchburg Div., B. & M. R. R., Fitchburg, Mass.
Clark, Wm. M., B. & O. R. R., Youngstown, O.
Cummin, Joseph H., Long Island R. R., Jamaica, N. Y.
Eggleston, William O., Erie R. R., 93 1st St., Huntington, Ind.
Flint, C. F., Central Vermont R. R., St. Albans, Vt.
Flynn, M. J., C. & N. W. Ry., Chicago, Ill.
Fullem, T. J., Ill. Cent. R. R., Chicago, Ill.
Geary, Sylvester, Penn. Lines W. of Pitts., Cambridge, O.
Heflin, R. L., Lehigh Valley R. R., Sayre, Pa.
Holmes, H. E., Central Vt. R. R., New London, Conn.
Hubbard, Andrew B., Boston & Maine R. R., Boston, Mass.
Johnson, J. E., Rutland R. R., Rutland, Vt.
Jutton, Lee, C. & N. W. Ry., Chicago, Ill.
Keefe, David A., Lehigh Valley R. R., Athens, Pa.
Keen, Wm. H., N. Y., N. H. & H. R. R., Hartford, Conn.
Kelly, C. W., Boone, Ia.
Killam, A. E., Intercolonial Ry., Moncton, N. B.
Large, C. M., Penn. Lines W. of Pitts., Jamestown, Pa.
Leake, Thomas S., Ill. Cent. R. R., 902 No. 1 Park Row, Chicago, Ill.
Leavitt, Frank J., Boston & Maine R. R., Sanbornville, N. H.

LEMOND, J. S., Southern Ry., Atlanta, Ga.
LICHTY, C. A., C. & N. W. Ry., Fond du Lac, Wis.
LYDSTON, WM. A., Boston & Maine R. R., Salem, Mass.
MACY, ELBERT C., Prin. Asst. Engr., C. & G. W. Ry., St. Paul, Minn.
MARKLEY, AARON S., Chicago & Eastern Ill. R. R., Danville, Ill.
MARKLEY, JOHN H., Toledo, Peoria & Western Ry., Peoria, Ill.
McGRATH, H. J., Intercolonial Ry., Moncton, N. B.
McKEE, D. L., Pittsburg & Lake Erie R. R., McKee's Rocks, Pa.
McKEEL, W. S., G. R. & I. Ry., Grand Rapids, Mich.
McKENZIE, W. B., Chief Engr., Intercolonial Ry., Moncton, N. B.
McLEAN, NEIL, Erie R. R., Huntington, Ind.
MILLS, R. P., N. Y. C. & H. R. R. R., 138th St., Mott Haven, N. Y.
MONTZHEIMER, ARTHUR, Chief Engr., E., J. & E. Ry., Joliet, Ill.
MOUNTFORT, ALBERT, Boston & Maine R. R., Nashua, N. H.
NOON, W. M., Duluth, South Shore & Atlantic Ry., Marquette, Mich.
OSGOOD, CLEON S., Portland & Rumford Falls Ry., Rumford Falls, Me.
PAGE, ADNA A., Boston & Maine R. R., Boston, Mass.
PARKER, J. F., Southern Cal. Ry., San Bernardino, Cal.
PATTERSON, SAMUEL F., Boston & Maine R. R., Concord, N. H.
PENWELL, JOHN N., L. E. & W. Ry., Tipton, Ind.
PERRY, W. W., Phila. & Reading Ry., 147 Market St., Williamsport, Pa.
PETTIS, WILLARD A., N. Y. C. & H. R. R. R., 73 Glendale Park, Rochester, N. Y.
PHILLIPS, HENRY W., N. Y., N. H. & H. R. R., So. Braintree, Mass.
PICKERING, B. F., Boston & Maine R. R., Sanbornville, N. H.
PORTER, L. H., N. Y., N. H. & H. R. R., Franklin, Mass.
POWERS, GEORGE F., C., L. S. & E. Ry., Joliet, Ill.
RAND, FRED C., Boston & Maine R. R., Boston, Mass.
REID, R. H., L. S. & M. S. Ry., Cleveland, Ohio.
RETTINGHOUSE, H., Wis. Cent. Ry., Fond du Lac, Wis.
RINEY, M., C. & N. W. R. R., Baraboo, Wis.
ROBERTSON, DANIEL, Southern Pacific Co., West Oakland, Cal.
SAMPSON, GEO. T., N. Y., N. H. & H. R. R., Boston, Mass.
SCHALL, FREDERICK E., Bridge Engr., Lehigh Valley R. R., South Bethlehem, Pa.
SHARPE, D. W., N. Y., N. H., & H. R. R., New London, Ct.
SHELDON, J. B., N. Y., N. H. & H. R. R., Providence, R. I.
SNOW, J. P., Bridge Engineer, B. & M. R. R., Boston, Mass.
SPAULDING, E. C., Boston & Maine R. R., St. Johnsbury, Vt.
STATEN, JOSEPH M., Chesapeake & Ohio Ry., Richmond, Va.
SWEATT, B. J., C. & N. W. Ry., Boone, Ia.

WATSON, P. N., Maine Central R. R., 5 Noble St., Brunswick, Me.
ZOOK, D. C., Penn. Lines West of Pittsburg, Ft. Wayne, Ind.

LIFE MEMBERS.

CRANE, HENRY, C. & N. W. Ry., Janesville, Wis.
FLETCHER, HOLLAND W., 366 California Ave., Allegheny, Pa.
WALDEN, W. D., C. & N. W. Ry., Clinton, Ia.

The following applicants for membership, subsequently elected, were also present:

BECKMAN, B. F., F. S. & W. R. R., Fort Smith, Ark.
COLE, J. E., C. Vt. R. R., St. Albans, Vt.
COOMBS, R. D., B. & A. R. R., Houlton, Me.
FAKE, C. H., M. R. & B. T. R. R., Bonne Terre, Mo.
HOPKE, W. T., B. & O. R. R., Grafton, W. Va.
JOSLIN, JUDSON, L. V. R. R., Auburn, N. Y.
RODMAN, G. A., N. Y., N. H. & H. R. R., Providence, R. I.
SHERWIN, F. A., B. & M. R. R., Springfield, Mass.
SWAIN, G. F., Engr. Mass. Railroad Com. Institute of Technology, Boston, Mass.
THOMAS, C. E., Ill. Cent. R. R., Chicago, Ill.

President.—Next order of business will be the reading of the minutes.

Mr. Cummin.—Inasmuch as the members of the Association have been in possession of the minutes for a number of months, I move that the reading of the minutes be omitted.

Mr. Large.—I second that motion.

President.—It has been moved and seconded that the reading of the minutes of the last convention be dispensed with. All members in favor of that motion will please make it manifest by saying "Aye." Those to the contrary, "Nay." It is so voted.

Mr. A. S. Markley.—Inasmuch as the remainder of the day will be devoted to business, I believe the ladies, perhaps, would rather retire than to stay here.

Mr. Cummin.—I believe that usually we do not allow the ladies to depart until after hearing the president's address, and it comes now in a few moments.

President.—I will just state, Mr. Cummin, that my address will be very brief.

President.—Next will be admission of new members. I think the secretary has a number of applications.

Secretary Patterson.—Mr. Lichty has the list of new applicants.

President.—I will appoint C. A. Lichty to act as assistant secretary, and request him to take his seat at my right hand and to read the applications.

Mr. Lichty thereupon read the list of new applicants.

REPORT OF COMMITTEE ON APPLICATIONS.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

The following applicants are recommended for membership in the Association:

F. W. BAILEY, Supt. B. and B., Missouri, Kansas & Texas Ry.
E. K. BARRETT, Supr. B. and B., Florida East Coast R. R.
C. C. BEAN, Supr. B. and B., Illinois Central R. R.
B. F. BECKMAN, Engr. M. of Way, Fort Smith & Western R. R.
B. A. BRIGGS, Supr. B. and B., Col. Springs & Cripple Creek Dist., Midland Term. & Florence & C. C. R. R.
J. E. COLE, Gen. foreman, Central Vermont R. R.
W. R. COLLIER, Supr. B. and B., St. Louis, Iron Mt. & So. R. R.
R. D. COOMBS, bridge Engr., Bangor & Aroostook R. R.
C. H. FAKE, chief Engr., Miss. River & Bonne Terre R. R.
JOHN FORBES, bridge Engr., Intercolonial Ry.
E. C. GEORGE, Gen. foreman B. and B., Gulf, Col. & S. F. Ry.
W. T. HOPKE, master carpenter, Baltimore & Ohio R. R.
J. W. IRWIN, Gen. foreman B. and B., Chicago & North Western Ry.
H. M. JACK, Gen. foreman B. and B., International & Great Northern R. R.
J. JOSLIN, Supr. B. and B., Lehigh Valley R. R.
FRED A. KNAPP, master carpenter, Erie R. R.
A. B. MCVAY, Supr. B. and B., Louisville & Nashville R. R.
WM. H. MOORE, Engr. of bridges, N. Y., N. H. & H. R. R.
S. P. MUNSON, Supr. B. and B., Illinois Cent. R. R.
P. J. O'NEILL, master carpenter, Lake Shore & Mich. Southern Ry.
WM. RENTON, master carpenter, Baltimore & Ohio R. R.
GEO. A. RODMAN, foreman B. and B., N. Y., N. H. & H. R. R.
W. B. ROGERS, Supt. B. and B., Chi., St. Paul, Minn. & Omaha R. R.
F. A. SHERWIN, roadmaster, Boston & Maine R. R.
CHAS. A. SIBLEY, Supr. bridges, N. Y., N. H. & H. R. R.
B. R. SIFFLER, bridge Engr., L. S. & M. S. Ry.
GEO. F. SWAIN, Engr. Mass. R. R. Commission, Boston, Mass.
C. E. THOMAS, Gen. foreman water works, Illinois Central R. R.
J. D. UPP, master carpenter, Chicago, Rock Island & Pacific Ry.
J. VAN DER HOEK, division engineer, Lehigh Valley R. R.
FRED E. WEISE, chief clerk B. and B. Dept., C., M. & St. P. Ry.
E. E. WILSON, Supr. B. and B., N. Y. C. & H. R. R. R.
KAMPER PEABODY, Gen. foreman buildings, N. Y. C. & H. R. R. R.
J. G. GOSSETT, Gen. foreman B. and B., M., K. & T. Ry.
EDWARD RYKENBOER, Supr. of buildings, N. Y. C. & H. R. R. R.

President.—You have heard the reading of the report of the Committee on Applications for membership. What is your pleasure?

Mr. Cummin.—I would like to ask if the committee has voted favorably on these names?

President.—Yes, sir, they have, on each one.

Mr. Cummin.—I move that the assistant secretary cast one ballot for all the names just read.

Mr. Montzheimer.—I second the motion.

President.—I believe that motion will require a unanimous vote. Those in favor of the motion, please so manifest by show of hands. Those opposed, the same. The motion prevails, and the assistant secretary will please cast the ballot, as directed.

President.—I hold here the ballot cast by the assistant secretary, and I declare these gentlemen duly elected as members of this Association.

President.—The next order of business is the president's address. It is unnecessary for me to say that I am no speech maker. However, if you will kindly bear with me, I will offer a few thoughts, which will constitute my address. (Applause.)

President.—Ladies and Gentlemen, Members of the Association of Railway Superintendents of Bridges and Buildings: We have gathered here this morning to open our sixteenth annual convention in this beautiful, old and historic City of Boston. To fully appreciate its many charms, you must know it. Visit the many public buildings of great historic interest, which might be called the homes of organized liberty in this country. Look through the grand and stately structures wherein are stored many of the finest works of science, art and literature. Walk through the elegant and spacious parks, and roam at will over the old common, celebrated in Revolutionary times as being free for all, and which today has no "keep off the grass" signs. Few cities of this country have such a wealth of pleasing suburbs as may be found surrounding Boston. Many of these are

teeming with historic interest, their fine old streets bordered with magnificent trees and lined with quaint cottages and commodious old colonial residences, whose first birthday occurred long before that of the great American Republic.

It is pleasant to see here many of the familiar faces of those who have helped to make this Association what it is today, and gladly do we welcome those who are meeting with us for the first time. It is a satisfaction to all to know that this Association is regarded by other well-known organizations, engaged in similar lines of work, as a factor of merit worthy to be recognized as coöperative workers in carrying forward the continual improvements in the execution of railroad bridge and building work.

Formed in 1891 by a few progressive men who believed there was a need of such a society for the benefit of busy workers in the bridge and building departments of the many railroads of this vast country, they have seen it grow from an experiment to an institution whose membership represents more than 170,000 miles of railroad.

While this Association deals with engineering problems in many lines, it has some distinctive features which make it of especial interest and benefit to those who supervise the work on railroad structures.

One of the topics which has always aroused a lively interest is the method of doing work. In the carrying out of work of any considerable importance, it is self-evident that there can be but one best way, and, in the saving of time and money, how necessary it is that we find that way.

Often the erection of bridges and other structures of importance can be given but scant attention by those at the head of the maintenance of way department, they being busy with other duties and cares; this is left entirely with the bridge or building man, and it becomes highly important that he be proficient in his line, to enable him to have the work done in the safest and best manner, at the minimum cost.

I think all will concede that experience is the best edu-

cator, and next to this is the experience of others, and this, perhaps, can be made available in no better way than by personal discussions in which are brought out many of the details showing the different customs in vogue with various persons, in obtaining similar results, and as a rule these details are a very important factor in the successful and economical execution of the work in progress, which in most cases, however important the structure, is but an aggregate of detail.

In the investigation of the subjects selected for reports and discussion there is no one who gets greater and more lasting benefit than those who take an active part in the work of the committees, making a careful and thorough study of the subject in its many bearings which will help them to make a creditable report, they have the data so firmly fixed in their minds that it is readily available at all times. And right here I would like to say that you can assist the president greatly when he is selecting the committees, if you will make it known that you would be willing to help, as he is much in need of workers at that time.

We have about the usual number of reports and these show a careful investigation by those having them in charge.

Our financial condition is good, we having a substantial fund in the hands of the treasurer, sufficient for ordinary contingencies, and all bills are paid.

There have been two meetings of the Executive Committee during the year, a report of which will be read by the secretary.

A circular letter, calling attention to the benefits of membership in this Association, was printed and sent out by the Committee on Membership to a large number who were eligible, but not members. Several applications were received as a result of this letter.

Death has invaded our membership during the year and parted from us Mr. T. H. Morgan, who was on the Northern Division of the Gulf, Colorado & Santa Fé Railway and located at Cleburne, Tex.

While our Association is a working society for the benefit of workers, it has its pleasanter and more social side, where its members, their families and friends meet, when many enjoyable hours are spent. Firm and lasting friendships are made, which broaden and cheer our lives, making us stronger and better fitted for our vocation and citizenship.

It has been our custom, if practicable, to spend a day after the close of the convention in visiting local points of interest, and many of you remember the huge furnaces, rolling-mills and steel and iron-working plants in and around Pittsburg, with an output of astounding magnitude.

Our Entertainment Committee have arranged for a trip, after the close of this convention, to some of the mammoth textile factories of Manchester, N. H., and to other interesting places on our way to the Portsmouth Navy Yard and York Beach, which we hope the excursion will be a pleasure and benefit to all.

In closing, I thank you heartily for the confidence shown, and the honor bestowed, by electing me president of this Association. In helping to carry forward the work, one becomes more than ever impressed with its benefits and possibilities, and I would share with you this wish: May the influence of the Association continue to widen and extend, and the good fellowship of its members never grow less. (Applause.)

President.—I think the next action in order will be the declaring of a short recess, for the collection of dues and to permit the ladies to retire.

Mr. Cummin.—Mr. President, I do not wish to be on the floor all the time, but I would state that we have some badges to be given out to our friends and guests, and I wish to say to them in this connection that we have felt a little disappointed with the badges given to you for the last two or three years, and we decided to try to improve them. We hope there is a change for the better in those which we present to you this year. If there is, give the credit of it to

the Association; if not, lay the blame on the committee, of which I was the only one.

President.—I would like to call your attention again to the cards on the table for our members to register their names upon, and the names of the road which they represent. We have also cards for visitors, and we wish them to be sure and register their names also. I will now declare a short recess.

A short recess was thereupon taken in order to give an opportunity for the payment of annual dues, distribution of badges, etc., after which the president again called the meeting to order.

President.—The next order of business will be the report of the secretary.

Secretary Patterson read his annual report.

REPORT OF SECRETARY.

To the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: Your secretary submits the following report for the year ending October 16, 1906. After a successful convention held in Pittsburg, the Association adjourned to meet in Boston October 16, 1906. The proceedings of the Pittsburg convention were printed and distributed as usual and the general instructions of the Executive Committee have been carried out. Death has entered our ranks and two have been summoned from us, our worthy member, Mr. T. H. Morgan of the Gulf, Colorado & Santa Fé Railway, and Mr. James Brady of the Chicago, Rock Island and Pacific Railway. The Obituary Committee will make proper mention of these sad events. We have now on our rolls 312 names of members and about thirty-four new applications, and the Association is in a prosperous condition. I wish to thank the members for their coöperation, also our advertising patrons for their liberal support and friendly greetings.

FINANCIAL.

Cash on hand at the last report	$156.31
Cash received for membership fees and dues	592.12
Cash received for advertisements	1,372.95
Cash received for sale of books	8.74
Total receipts	$2,130.12
CR.	
By cash paid out, for which I hold vouchers	$2,013.68
Balance on hand	$116.44

S. F. PATTERSON,
Secretary.

President.—You have heard the report of the secretary. What is the pleasure of the meeting?

Mr. Cummin.—I move that it be referred to the Auditing Committee.

Motion seconded and carried.

President.—Next in order will be the report of the treasurer.

Assistant Secretary Lichty read the report of the treasurer.

REPORT OF THE TREASURER.

LAWRENCE, MASS., October 15, 1906.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: Your treasurer submits the following report for the year ending October 16, 1906:

Cash on hand last report	$761.18
May 23, 1906, donation by treasurer	.87
May 23, 1906, interest to May, 1906	25.06
June 21, 1906, received from secretary	200.00
Total on deposit	$987.11

The members of this Association may think it strange that your treasurer should make a donation of 87 cents. My reason for doing this was that when I received the funds from my predecessor there was $582.13. Inasmuch as the bank will not receive any deposit less than $1, I have carried the 13 cents long enough. May 23, 1906, I put the 87 cents with the 13 and deposited $1, so that I would not have to report, "Cash on hand, 13 cents."

Yours very truly,

C. P. AUSTIN,
Treasurer.

President.—You have heard the reading of the treasurer's report.

Mr. A. S. Markley.—I move that it be referred to the Auditing Committee.

President.—At this time I will announce as members of the Auditing Committee, Messrs. A. Montzheimer, R. P. Mills and M. Riney, and if they will please take charge of the reports of the secretary and treasurer, we will await their report on same.

President.—Next order of business is the report of the Executive Committee.

Secretary Patterson then read the report of the Executive Committee.

REPORT OF THE EXECUTIVE COMMITTEE.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: The committee met at the close of our fifteenth annual convention at Pittsburg, Pa., and outlined the work for the coming year. The work of appointing the various committees was left with the president, and later he issued a circular giving the names of the committees chosen. The secretary was instructed to print 1,100 copies of the Proceedings of the Pittsburg Convention, and to arrange with Mr. Steffens to assist in editing.

Mr. J. H. Cummin was appointed a committee of one to procure badges.

No further business appearing, the meeting adjourned to the call of the president.

Agreeable to the call of the president, the Executive Committee met at the American House, Boston, Mass., Monday evening, October 15, and transacted the usual routine business, and discussed the subject of a place for the meeting of the next convention, with no definite decision or recommendation. On motion adjourned.

S. F. PATTERSON,
Secretary.

President.—You have heard the reading of the report of the Executive Committee. What do you wish to do with it?

Mr. A. S. Markley.—I move that the report be accepted and printed in the regular proceedings.

President.—All in favor of that motion, please manifest it by saying "Aye." Those opposed, "Nay." It is so voted.

President.—We will now proceed to the hearing of the reports of committees on subjects for report and discussion.

President.—Subject number one, "Concrete Bridges and Subways." The chairman of that committee is G. E. Hanks of the Pere Marquette Railway Company, Saginaw, Mich. The secretary informs me there is no report on this subject. If there is nothing to be heard in regard to this, we will pass on to subject number two.

Mr. A. S. Markley.—Before proceeding further, I would like to ask if it is not necessary for the Nominating Committee to be appointed at this time.

Mr. Cummin.—It has been the custom to appoint the

Committee on Nominations, and, in fact, all the necessary committees, as early as possible, and I think it might be well to appoint them at this time, so that they may have an opportunity to make out a full and complete report,—the Auditing Committee, Committee on Resolutions, Nominating Committee, etc.

President.—Gentlemen: I would announce on the Nominating Committee, Messrs. A. S. Markley, W. O. Eggleston, J. H. Cummin, B. F. Pickering, C. M. Large; and for the Committee on Resolutions I will appoint J. N. Penwell, J. S. Lemond, R. H. Reid.

Mr. Cummin.—I notice that Mr. Berg is on the Committee on Selection of Subjects. I went to his office to learn if he were coming here or not, but he stated that it would be impossible for him to be at this meeting, and as he is chairman of that committee, I would suggest that Mr. Schall of the Lehigh Valley be appointed in his place.

President.—I would be pleased to appoint Mr. Schall to represent Mr. Berg on the Committee on Selection of Subjects.

President.—We will now listen to the report of the Committee on Memoirs, which the assistant secretary will please read.

Report read by Assistant Secretary Lichty.

REPORT OF COMMITTEE ON MEMOIRS.

Your Committee on Memoirs presents herewith memoirs of our deceased members, as follows: James Brady, who died August 28, 1905, and Thomas H. Morgan, who died May 5, 1906.

H. W. Fletcher,
Committee.

MEMOIR.

James Brady.

James Brady, elected a member of this Association October 15, 1895, died August 28, 1905. James Brady was born at Lindsay, Ontario, from which place when a mere child his parents removed to New York, where he received a common school education, and early in life learned the carpenter's trade, from which to the building of wooden bridges was a most natural step to one with his capacity and inclinations.

For many years he was in the service of the Boomer Bridge Building Company and their successors in Chicago, during which

time he successfully superintended the erection of many important structures in different parts of the United States. About the year 1877 he accepted a position as superintendent of bridges and buildings on the Keokuk & St. Louis line, which he resigned in 1881 or 1882 for a similar position in the service of the C., R. I. & P. Railway Co., with office first in Washington and later in Davenport, Iowa. He filled this position for more than twenty years with much credit to himself and to the satisfaction of his superiors and associates. In 1903 he became a member of the General Construction Co., of Iowa, acting as superintendent thereof until early in January, 1905. Mr. Brady was at all times an earnest, efficient, industrious and conscientious man. He was respected by his employers and loved and admired by those who worked for or under him. He was a devoted husband and father.

His death came August 28, 1905. He was conscious to the end and closed his eyes surrounded by his grief-stricken family. He is mourned and respected by those who knew him.

MEMOIR.

Thomas H. Morgan.

Thomas H. Morgan, elected a member of this Association October 18, 1904, died May 5, 1906, aged 47 years.

Mr. Morgan was born in Tennessee, his parents removing to South Central Missouri when he was quite small. He worked on the A., T. & S. F. Railway under B. Cross, now general foreman Oklahoma division. He was appointed general foreman of bridges and buildings of Illinois section of the Chicago division about 1893, and held that position until November, 1901, then going to the G., C. & S. F. Railway, Cleburne, Tex., where he held the same position until the time of his death. He is survived by his wife and two daughters. Mr. Morgan's genial disposition, and his upright and honorable character won for him many friends.

President.—You have heard the reading of the report of the Committee on Memoirs. What is your pleasure?

Mr. Cummin.—I move that it be received and spread in full on the records.

Mr. Montzheimer.—Second the motion.

President.—All in favor of that action, please say "Aye." The motion prevails.

President.—We will now listen to reports of committees on subjects. On subject number one, I believe there is no report. Number two, "Experience and Use of Concrete and Timber Piles." The chairman of that committee is Mr. W. H. Finley and I believe that none of the committee are present. I will therefore call upon our assistant secretary to read that report.

President.—I thought we had a report on that subject, but we have failed to find it.

President.—Next in order will be number three, "Concrete Building Construction." I think we have no report on that; the secretary so states. The next in order will be number four, "Method of Watering Stock in Transit," and I have been asked to defer the reading of that until this afternoon.

President.—Next will be number five, "Recent Practice in Cofferdam Work," Mr. Aldrich, chairman. I will ask him to give a brief synopsis of that report.

Mr. Aldrich.—I think the report has been printed and sent out to nearly all the members, and I do not know anything further to say than that which has already been printed in the report.

Mr. Reid.—I think as Mr. Aldrich does, that all the reports that are printed and in the hands of the members, we should pass over without reading. We can make such notes as desired, and I believe where we have printed reports, unless there is something to be brought out in addition, that the reading of the reports should be omitted. (See report.)

President.—If there are any additional reports, we will be glad to hear them. Sometimes we have supplementary reports and if there is anything of the kind to be presented by the committees we will be glad to hear them.

President.—Next is number six, "Modern Coaling Stations and Cinder Pits," chairman, Mr. J. S. Browne. I think that committee has a report and it has been printed and is in the hands of the members. I will ask Mr. Browne if he has any supplementary report to make. (See report.)

President.—Mr. Browne is not in the room, and if there is no additional report to be made on this subject we will pass to the next one, which is number seven, "Bumping Blocks for Passenger and Freight Use," chairman, A. E. Killam of the Intercolonial Railway. I would like to ask if he has any further information to be presented on the subject.

Mr. Killam.—Mr. President. Since I issued the report I have received a good many replies in reference to the subject of bumping blocks, but they did not give very much new light on the matter. For bumping posts they appear to favor those manufactured by the Gibraltar and Ellis companies. The Ellis is used on the Intercolonial Railway altogether. But a few days ago I received a long report from Mr. Higgins, who is now the assistant engineer on the Panama Canal, and I have placed it, with the others. I think that with the exception of this one letter, all has been said that can be said in reference to this subject.

President.—Mr. Killam, perhaps some of the members would like to have that additional report or letter read, and I will ask our assistant secretary to please read it.

Supplementary report to the regular report read by Assistant Secretary Lichty. (See letter and report.)

Mr. Cummin.—I would like to ask if the assistant secretary did not make a slight mistake in reading the second page, where the gentleman speaks of the enormous weight of the cars of fifty to one hundred tons. I know we now have in use cars of fifty tons' weight, but I have never seen any of one hundred tons.

Mr. Reid.—Mr. Chairman, there are cars of one hundred tons' weight. We get them over the Lake Shore, and some of one hundred and fifty tons' weight. Quite a good many are used for transporting heavy forgings, steel, etc.

Mr. Cummin.—I have not seen any of them and I do not wish to see them.

President.—You have heard this letter. I think that completes all the reports on the regular subject for discussion, and we will now turn to Committees on Standing Subjects. The first one is "Pile and Frame Trestle Bridges." Mr. Canty of the Boston & Maine Railroad is chairman, and he has a very good and complete report. (See report.)

Mr. A. S. Markley.—It is too late to take up those subjects now, and I move that we adjourn till 2 o'clock p. m.

President.—All those in favor of that motion will please manifest by show of hands. The motion prevails and we stand adjourned till 2 o'clock p. m.

AFTERNOON SESSION.

TUESDAY, October 16, 1906.

President.—Gentlemen: It is now past 2 o'clock and you will please come to order. I would like to ask the members to come forward and fill up the front seats. We will now proceed with our regular order of business. I think for our next report we will have that of the Auditing Committee, to be read by the assistant secretary.

REPORT OF AUDITING COMMITTEE.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

Secretary's report:	
Cash on hand last report	$156.31
Received during the year for dues and membership fees.	592.12
Received for sale of books	8.74
Received for advertising	1,372.95
Total	$2,130.12
Disbursements:	
Expenses, as per vouchers	2,013.68
Balance in secretary's hands, October 16, 1906	$116.44
Balance in hand of treasurer same date	987.11
Cash balance on hand	$1,103.55

ARTHUR MONTZHEIMER,
M. RINEY,
R. P. MILLS,
Auditing Committee.

President.—You have heard the report, and I will state that this does not include the membership fees or dues paid in at the present meeting.

Mr. Cummin.—I move that it be received and spread in full on our minutes.

Mr. Montzheimer.—I second that motion.

President.—All in favor of that motion please say "Aye." The motion prevails.

Mr. Cummin.—Allow me to say that I have noticed that our secretary is not present, and during his absence I would like to say a few words. I think about three fourths of the money received during the past year has been received from advertising, and I believe I am safe in saying that our secretary secured fully ninety per cent. of that advertising. The subject of properly remunerating our secretary has been talked over by the Executive Committee, but they do not believe they have the power to act, according to our constitution, and they concluded that the matter should be brought up before the entire convention, and I know you will all agree with me that the old saying, the "laborer is worthy of his hire," applies here, and I move that the salary of the secretary of this Association be made six hundred dollars per year.

Mr. A. S. Markley.—I second the motion.

Motion also seconded by several other members.

Mr. Lichty.—For the benefit of those members not informed in regard to the present salary of our secretary, I would state that I think it is four hundred dollars per annum.

President.—Are there any further remarks? I would like to say that I have been associated with Mr. Patterson for the past year and I personally know that he takes a great interest in the work and also that the work requires a great amount of his time, and he has handled it very efficiently; as stated, he is responsible for practically all the money we have received from advertisements, and I am sure that while the sum mentioned is a considerable increase, he has earned it. It has been stated here before in our conventions, by one of our former presidents, that he had noticed the rise and fall of an association was very closely connected with the efficiency of its secretary, and we all think we are on the rise, proving conclusively to most of us who have had actual business relations with the secretary, that he is worthy of more than he is receiving at the present time.

Mr. Lemond.—I think that his services are well worth

six hundred dollars a year, and I second the motion heartily and would like to state that we are all interested in this matter and if every member of this Association would take a little time, he might secure a few advertisements. I went out and in a short time secured two or three, and if every member would do the same, we might realize a good deal more money from that source.

President.—All in favor of the motion, please manifest by a show of hands. It is unanimously voted that the secretary receive the increase in salary.

Secretary Patterson (upon re-entering the hall and being informed of the action of the Association) said: "Allow me to say, friends, members of the Association, that I appreciate your remarks concerning the increase in my salary being well earned. I could not conscientiously accept it, if I did not feel sure that you realize that I have put my very best effort into the work. The prosperity of the Association is a matter of great interest to me; my heart is in the work, and I shall endeavor to faithfully fulfill the requirements of the office with which you have so long honored me. I thank you."

President.—Next we will hear the report of the Committee on Relief.

Assistant secretary read report of the Committee on Relief.

REPORT OF COMMITTEE ON RELIEF.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

Your Committee on Relief which was appointed at the last annual meeting is glad to inform you that during the past year no requests for relief have been made.

ARTHUR MONTZHEIMER,
J. W. MORGAN,
W. A. ROGERS,
Committee on Relief.

President.—That is certainly a very pleasing report to hear, with a membership of something over three hundred.

Mr. A. S. Markley.—I move the report be received and published in our proceedings.

Motion seconded and carried.

President.—I notice the next regular report is that of "Pile and Frame Trestle Bridges." Mr. Canty, the chairman, made quite an extensive report, which is now in the hands of the members, but I would like to ask if there is anything further to be added at this time.

Mr. Canty.—Nothing especially, Mr. President, except to state something in connection with Mr. Killam's report; that we received, after formulating our report, a good many letters from the different members and as practically all these contained valuable information it was thought it would be wise to include these in the appendix to the report. Among these after reports received, two were from prominent members from New Zealand, which were very interesting, and I think will add considerable value to our report. (See reports.)

President.—The next is subject number two, "Steel Bridges," Mr. A. O. Cunningham, chairman. I do not think there is any report on it. Mr. Cunningham is not in the room now. Are there any of the other members who have anything to say on this subject? (No report.) If not we will pass on to the next subject, number three, "Buildings," Mr. W. B. Causey of the C. & A. Ry. Co., Bloomington, Ill., chairman. Not heard from. Are there any of the other members of that committee present? No report on this subject, and none of the members being present we will pass to the next report, number four, "Water Supply," Mr. B. M. Hudson, chairman. Mr. Hudson is not here, but one of the other members of that committee, Mr. H. Rettinghouse, is present and I will ask if he has anything to say, as I believe there is no report.

Mr. Rettinghouse.—I know of no report. I remember receiving a letter from Mr. Hudson inviting some correspondence, but I have not heard anything from him since.

President.—If no report is made on this subject we will pass it and take up the next, number five, "Fire Protection," Mr. George W. Andrews, chairman. He is not here. We have a report on this subject, however, but I notice one

of the other members of that committee is present, Mr. Zook, and I will ask him if he knows of anything to be added to that report.

Mr. Zook.—Mr. President, I know of nothing further than what is embodied in the report. (See report.)

President.—The next is number six, "Fences, Road Crossings and Cattle Guards," Mr. A. Findley, chairman. No report, and I think none of the members of the committee are present; if they are, we would be gad to hear from them if they have anything to say; if not, we will pass on to the next subject, number seven, "Preservatives for Wood and Metals," Mr. F. D. Beal of the Southern Pacific, West Oakland, Cal., chairman. I think we have a report on this subject. Are any of the members of that committee present? The report has been printed and is now in your hands. (See report), and we will take up the next and last subject, number eight, "Records and Accounts," on which there is no report. Mr. R. C. Sattley is the chairman. If any of the other members of that committee are present and can give us any information in regard to their subject, we will be glad to hear it.

Mr. Lemond.—I have no information, Mr. President, as I have never heard from the chairman or any of the members of the committee. I presume nothing has been done.

President.—I received a letter early in the season from Mr. Sattley, stating that he hoped to be able to prepare a report and I presume he has some very good reason for not doing so.

Mr. Lichty.—I am of the opinion that we will hear from him before the close of the meeting.

President.—We will be glad to.

President.—I think at this time I will take the opportunity to appoint on the Obituary Committee, Mr. Perry, Mr. Noon and Mr. Riney.

President.—I think we have now completed the list of subjects. The next action in order will be the discussion of last year's subjects. I believe that is the regular order, or

which do you wish to discuss first, the reports of this, or of last year?

Mr. Cummin.—I think it would be much better to take the subjects of this year and go over them thoroughly; if we have any time left, we can go back to last year's reports.

President.—Perhaps that would be a good business policy. We will take up the discussion then of this year's subjects, and the first is subject number one, "Concrete Bridges, Arches and Subways." There is no report on this subject, which enhances the need of a good discussion. I certainly think there are very few members here who have not had more or less to do with concrete arches, culverts and subways, and if they will give us the benefit of their experience it will be of value and interest to all. (See discussion on subject number one.)

President.—The next subject to be taken up is number two, "Experience and Use of Concrete and Timber Piles," Mr. W. H. Findley, chairman. There is no report on this subject. Has anyone anything to say? (See discussion on subject number two.)

President.—"Concrete Building Construction" is the next subject, number three, on which there is no report. Has anyone anything to say on this subject? (See discussion on subject number three.)

Mr. A. S. Markley.—I move that we now adjourn until 10 o'clock tomorrow morning.

President.—If there is no objection to this, the meeting will be adjourned until 10 o'clock tomorrow morning.

MORNING SESSION.

WEDNESDAY, October 17, 1906.

President.—The time has arrived for the opening of our session, and the first action in order will be to take up again subject number two, "Experience and Use of Concrete and Timber Piles." We had some discussion on this subject last evening, and perhaps some of the gentlemen here would

like to make some further remarks concerning it, or to ask some questions.

Mr. Parker.—Before starting on the deliberations of this session, I would like to ask the members to speak loud, and distinctly enough to be plainly heard all over the room. The object of this convention is to gather information one from another, and I am sure it will help us a good deal if we speak so as to be heard distinctly, and it will tend to make the meeting much more interesting.

President.—We will be glad to have you bear in mind Mr. Parker's remarks. (See continuation of discussion on subject number two.)

President.—Subject number three, "Concrete Building Construction," is now open for discussion, gentlemen. There is no report on this subject; will you have a further discussion on the same? We have already had quite a lengthy discussion on "Concrete Bridges, Arches and Subways." We had no report on that subject, and perhaps we could have something of a discussion on this. If any of the members have had any experience in regard to same, or desire to ask questions, we would like to hear from them. (See continuation of discussion on subject number three.)

President.—Gentlemen, we are now ready to take up subject number four, "Methods of Watering Stock in Transit." There is a printed report on this subject by Mr. J. H. Penwell, the chairman, who also has some supplementary letters bearing on the same. Mr. Penwell is at the present time ill in his room here, so I will ask our assistant secretary, Mr. Litchy, to read the letters. (See letters on the subject which constituted the supplementary report on subject number four.)

President.—Gentlemen, you all have a report on subject number four in your possession, and we will now be pleased to listen to any remarks that you have to make on this subject. (See discussion on subject number four.)

President.—The next subject to be taken up is number

five, "Recent Practice in Coffer Dam Work." (See discussion on subject number five.)

President.—Our next subject is number six, "Modern Coaling Stations and Cinder Pits," Mr. J. S. Browne, chairman. There is a printed report here on this subject; also quite a collection of blue prints. Mr. Browne, the chairman, suggests that inasmuch as this report is not as complete as it might be that it be continued as one of our subjects for another year, if it is thought advisable. (See discussion on subject number six.)

President.—Our assistant secretary, Mr. Lichty, would like to read some communications which he has received.

Mr. Lichty.—Gentlemen, we have two reports which I would like to read at this time; the first one is the report of the Committee on Selection of Subjects.

REPORT OF COMMITTEE ON SELECTION OF SUBJECTS.

Boston, Mass., October 17, 1906.

To the President and Members of the Association of Railway Superintendents of Bridges and Buildings:

Your Committee on Selection of Subjects presents the following report on questions to be submitted for next year's work.

Number one. Experience in concrete bridges, arches and subways.

Number two. Concrete building construction.

Number three. Experience as to expansion and contraction of long concrete walls, either reinforced or plain concrete.

Number four. Action of sea water on concrete:

(a) Concrete made in the air and sunk into sea water.

(b) Concrete deposited direct into sea water.

Number five. Recent experience in the use of wooden and asbestos smoke jacks for engine houses.

Number six. Combination fastenings and locks for rolling and sliding doors on freight houses and other buildings.

Number seven. Construction of towers and guides for lights on drawbridges.

Number eight. Recent experience in protecting steel railroad bridges against the action of brine from refrigerator cars.

F. E. Schall,
W. M. Clark,
J. H. Cummin,
Committee.

Mr. Lichty.—The second report I have is the report of the Nominating Committee.

REPORT OF COMMITTEE ON NOMINATIONS.

BOSTON, MASS., October 17, 1906.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

Your Committee on Nominations submits the following report for officers for the ensuing year:

For President—J. H. Markley.
First Vice-President—R. H. Reid.
Second Vice-President—J. P. Canty.
Third Vice-President—H. Rettinghouse.
Fourth Vice-President—F. E. Schall.
Secretary—S. F. Patterson.
Treasurer—C. P. Austin.
Executive Members—W. O. Eggleston, A. E. Killam, J. S. Lemond, C. W. Richey, H. H. Eggleston, B. J. Sweatt.

A. S. MARKLEY,
J. H. CUMMIN,
C. M. LARGE,
W. O. EGGLESTON,
B. F. PICKERING,
Committee.

President.—It is not necessary to take any action on these papers at this time, as they will come up again later.

The assistant secretary then read a letter from Mr. George J. Akers, under date of October 16, 1906, stating that Captain Sanborn of the South Station terminal tenders an invitation to the Association as a body to visit the South Station terminal and the Sherzer lift bridge; also to inspect two Fairbanks gasoline motor cars.

Mr. Cummin.—I move that the thanks of this Association be extended to this gentleman, and also that he be notified by our secretary that under the circumstances, it is impossible for us to accept the invitation.

Mr. A. S. Markley.—I second that motion.

President.—All in favor of that motion please say "Aye." The ayes have it.

President.—As these gentlemen have shown us considerable attention since our coming here, and as it will be impossible for us to accept their invitation to go in a body, I will be very glad if any who can, will go individually.

Mr. Lichty then read a number of letters of regret from members who were unable to be present. Also a special letter from Mr. O. J. Travis, as follows:

DENVER, COL., September 28, 1906.

My Dear Mr. Patterson:

I regret very much that I cannot attend the meeting of the Association in Boston next month. I had hoped to be able to attend at least one more meeting before retiring from the bridge and building business, but probably I will not be able to do so. I am hoping to permanently retire from railroad work sometime early next year, at the farthest. I would have been glad to have met with all our old friends and members, and also to have made the acquaintance of our many new ones, all of whom I know are working zealously in the cause of the Association.

I hope, however, that the next meeting will take place in that young city of the Pacific coast, Seattle, and that then I will be able to meet with you. With best wishes for the continued success of the Association and kindliest personal regards to you and all the friends, I am, sir,

Yours very truly,

O. J. TRAVIS.

Mr. Cummin.—Inasmuch as this comes from the first president of this Association, I move that our secretary be instructed to express to Mr. Travis our sincere regret concerning his inability to be with us here in Boston. He was the organizer of the Association, and the first president.

Mr. A. S. Markley.—I second the motion.

President.—Gentlemen, you all understand the motion, and as many as are in favor of it say "Aye," contrary "Nay." The motion prevails.

Mr. Cummin.—I move that we adjourn until two o'clock.

President.—If there is no objection the meeting stands adjourned until two o'clock this afternoon.

AFTERNOON SESSION.

WEDNESDAY, October 17, 1906.

Meeting called to order at two o'clock p. m. by President Sheldon.

President.—I think our last subject discussed before we adjourned for lunch was number six, "Coaling Stations"; the next will be number seven, "Bumping Blocks for Passenger and Freight Car Use." We have a printed report on that subject. (See report.) Mr. A. E. Killam is chair-

man of that committee, and we will be glad to have him open the discussion. (See discussion on subject number seven, "Bumping Blocks for Passenger and Freight Car Use.")

Mr. Reid.—Mr. President, I would like to present the question in regard to the roller lift bridge, and the motor cars, which the Fairbanks people have sent here. In talking to some of the members, the suggestion was made that we follow the same plan as we did this morning in visiting the concrete pile work, and I would suggest that we try to arrange to go down there at eight o'clock tomorrow morning, that is, to the South Terminal station. As these parties have gone to some trouble and to some expense in bringing those motor cars here, and as they are matters of interest to all of us, and I should be very glad to see both the roller lift bridge and the motor cars, etc., and I move that we see some of these people who are familiar with the location and leave here at eight o'clock tomorrow morning.

Mr. Cummin.—I second the motion.

Motion pervailed.

President.—As we have now finished the discussion on the regular committee reports for this year, the next subjects to come before the convention are the committee reports on standing subjects, which are continued from year to year. The first is subject number one, "Pile and Frame Trestle Bridges." Mr. Canty, the chairman of this committee, has a very good printed report, which is now in the hands of the members, and I will ask Mr. Canty if he has anything further to say in the way of supplementary remarks. (See discussion on subject number one, "Pile and Frame Trestle Bridges.")

President.—We will now take up the next subject, which is number two, "Steel Bridges." Mr. A. O. Cunningham is chairman and there is no report. Have you anything to say in regard to this subject? (See discussion on subject number two.)

President.—We will now take subject number three,

"Buildings." No report has been made on that subject by the committee, either this or last year. I think it has now been carried over for two years. Has anyone anything to say in regard to it? I think none of the members on that committee are present. Mr. W. B. Causey was the chairman. If there is nothing to be said on this subject, we will pass on to the next, number four, "Water Supply." No discussion on subject number three, "Buildings."

President.—Gentlemen, we will now take up subject number four, "Water Supply." Mr. B. M. Hudson is chairman. Mr. Hudson is not here; Mr. Rettinghouse and Mr. Riney are present. Have either of these gentlemen any information to give on this subject, or any of the other members anything to say regarding it? (See discussion on subject number four, "Water Supply.")

President.—If there is nothing further to be said on the subject of "Water Supply," we will pass on to the next subject, "Fire Protection," Mr. George W. Andrews, chairman. (See report.) Mr. Zook, have you anything further to say on this subject?

Mr. Zook.—No, sir; I have nothing further to say.

President.—We shall be glad to hear any discussion on the matter of fire protection, if you desire to discuss the report. If there is nothing to be said on this we will pass on to the next. (No discussion on subject number five, "Fire Protection.")

President.—We will now take up subject number six, "Fences, Road Crossings and Cattle Guards."

Mr. Aldrich.—Mr. President, before we take up the next subject, if it is in order, I have a matter that I would like to bring before the convention at this time, a great affliction has befallen one of our members. Mr. Keen has lost his wife. He is seventy-six years old, and I think if our secretary would write him a letter of sympathy that it would be very pleasing to him, and I make that as a motion.

Mr. Cummin.—Second the motion.

Motion prevailed.

President.—We will now proceed with subject number seven, "Road Crossings, Cattle Guards," etc. This is quite a broad field with some of the railroad companies, at least I know it is with us. All highway bridges are chargeable under that head on our line; I do not know how it is with the other companies,

Mr. Lichty.—I would like to hear a discussion on cattle guards, and I wish to know what the different members consider the best cattle guard. (See discussion on subject number seven, "Fences, Road Crossings, and Cattle Guards.")

President.—We are now ready to take up the next subject, which is number seven, "Preservatives for Wood and Metals." Mr. F. D. Beal is chairman. None of the members of that committee are present, but this is a very important subject, as the price of timber is rapidly increasing. (See discussion on subject number seven, "Preservatives' for Wood and Metals.")

President.—We are now ready to take up subject number eight, "Records and Accounts." Mr. R. C. Sattley is chairman. (No report.)

Mr. Cummin.—The Maintenance of Way Association have a standing committee on the subject of records and accounts. It is a clerical subject, and I do not think it would be advisable for the members of this Association to discuss it. I think it would be a good idea to drop that subject from our list.

Mr. A. S. Markley.—The auditor is the person who verifies all these accounts, etc., that is, when it comes to accounting for the amount expended in the maintainance of way department.

Mr. Eggleston.—I move that we drop this subject at once.

Mr. Cummin.—Second the motion.

President.—All those in favor of dropping this subject will say "Aye." Motion is carried. I think that completes all the subjects for discussion.

Mr. Eggleston.—I move that we adjourn till ten o'clock tomorrow morning.

Mr. Markley.—Second the motion.

President.—We now stand adjourned till ten o'clock tomorrow morning.

MORNING SESSION.

THURSDAY, October 18, 1906.

President.—Gentlemen, you will please come to order. Our time is limited and we have a great deal to do. I think we finished the discussion of all our reports last evening and the next matter in order will be unfinished business.

President.—If there is no unfinished business to come before the meeting at this time, we will take up the reports of committees. We have the report of the Committee on Selection of Subjects, which has not yet been adopted. Assistant Secretary Lichty read the report of the Committee on Subjects for investigation for next year's work. (See report previously read by Mr. Lichty.)

President.—You have heard the reading of the report. Gentlemen, what is your pleasure?

Mr. Killam.—I move the adoption of the report.

Mr. Cummin.—Second the motion.

President.—All those in favor of the motion please manifest by show of hands. It is so voted.

Mr. Cummin.—I move that the following standing subjects be eliminated from the list: The second one, "Steel Bridges"; number three, "Buildings," and the eighth subject, "Records and Accounts."

Mr. Markley.—I second the motion.

President.—You have heard the motion made and seconded that we eliminate steel bridges, buildings, and records and accounts from our subjects. Are there any remarks to be made; if not, all those in favor of that motion please so manifest by a show of hands. Those opposed to the same. It is so voted.

President.—I understand the other subjects remain as they are.

President.—We will now hear the report of the Obituary Committee.

The report of the Obituary Committee was read by the assistant secretary:

REPORT OF OBITUARY COMMITTEE.

It has been the will of God to take from our number two of the faithful members of our Association, thus reminding us of the uncertainty of life and the importance of being prepared for death; therefore be it

Resolved, That we as an Association sincerely mourn the loss of these beloved brothers: T. H. Morgan and James Brady.

Resolved, That the sympathy of this Association be tendered the widows and families of these deceased brothers by the secretary and that a copy of these resolutions be printed in full in our proceedings and also a copy forwarded to the respective families of the deceased.

C. A. LICHTY,
A. E. KILLAM,
Committee.

President.—Gentlemen, you have heard the report of the Obituary Committee.

Mr. Cummin.—I move that we adopt the resolutions as read.

President.—It is so voted.

President.—The report of the Committee on Resolutions is not quite ready. Is there any new business to come before the meeting?

Mr. Lichty.—Mr. President, I would like to call the attention of the meeting to the accident which befell our worthy friend, who has been a member of our Association for a number of years, Mr. John Schwartz, of the Chicago, St. Paul, Minneapolis & Omaha System, Emerson, Neb. Last year he met with an accident, which caused him to lose one of his legs, and he and his family are in very straitened circumstances. He has for a long time been afflicted with Bright's disease. He writes a very touching letter to our secretary, saying that he will not be able to keep up his

dues, and he would like to be remembered to the members of the Association, etc. I think we should make him a life member, and I would like to have some one make a motion to that effect.

Mr. Killam.—I move that Mr. Schwartz be made a life member of this association.[1]

Mr. Cummin.—I second the motion, with the suggestion that our secretary be instructed, when he notifies Mr. Schwartz of his election to life membership, that he also tender the sympathy of the members of this Association to him in his affliction.

Mr. President.—Gentlemen, you have heard this motion, that Mr. John Schwartz be elected a life member of this Association, with all its privileges, and that our secretary be instructed to write a letter of condolence sympathizing with him in his trouble. All those who favor that motion, please say aye, contrary nay. It is so ordered.

Mr. Cummin.—While the Committee on Resolutions are completing their report, I move that we take up the matter of location of our next meeting.

President.—It is moved that we now take up the subject of place of the next meeting. All that favor that motion, please say "Aye," those opposed "Nay." It is so ordered.

Mr. Cummin.—I move that a committee of three be appointed on the subject of transportation, consisting of Messrs. Montzheimer, Lichty and Rettinghouse.

Mr. A. S. Markley.—I second that motion.

President.—Are there any remarks to be made?

Mr. Large.—Would it not be well to distribute this committee around through the different sections of the country?

Mr. Cummin.—Mr. Large, I will say that the letters sent by that committee to the officials of the different railroads will be signed by the chairman of that committee. All the letters will naturally come from him.

Mr. Killam.—I think that it would be necessary for a

[1] Mr. Schwartz died April 7, 1906. Information received after convention adjourned.

committee of that kind to be near each other, so that they could consult together when necessary.

Motion seconded and carried.

President.—We are now ready to take up the report of the Committee on Resolutions and will have it read by Assistant Secretary Lichty.

REPORT OF COMMITTEE ON RESOLUTIONS.

BOSTON, MASS., October 19, 1906.

Your Committee on Resolutions respectfully submit the following report:

Resolved, That the thanks of this Association are hereby tendered to the railroads, the Pullman and other companies, individually and collectively, in appreciation of the courtesies extended in connection with our sixteenth annual convention.

To the Boston & Maine Railroad, for providing special trains for trips to textile mills, navy yard, York Beach, Boston terminals, etc.

To President Lucius Tuttle of the Boston & Maine Railroad, for his opening address.

To President Eliot and faculty of Harvard University for their hospitable entertainment; and Professor Swain for his interesting address.

To the various manufacturing and construction companies in Boston for their courtesies.

To Admiral Meade, of the U. S. navy, for courtesies shown at Portsmouth navy yard.

To the Boston dailies and technical journals for reports of the meeting of the convention.

To the various manufacturing firms and supply houses, who made exhibits at the convention and assisted so generously in the entertainment of the members and their ladies.

J. N. PENWELL,
R. H. REID,
J. S. LEMOND,
Committee.

Mr. Clark.—I move the report be adopted.

Mr. Cummin.—Second the motion.

President.—All in favor of that motion, please so manifest by saying "Aye," those opposed "Nay." The motion prevails, that we adopt the report of the Committee on Resolutions.

President.—We are ready to receive nominations for the place in which to hold our next convention.

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Mr. Rettinghouse.—I place in nomination the City of Milwaukee, Wis., for our next meeting place.

Mr. Cummin.—I nominate Salt Lake City, Utah.

Mr. Clark.—I nominate Norfolk, Va.

Mr. Patterson.—I nominate New York City.

Mr. Cummin.—I move that the transportation committee in the event that they cannot do justice to the members in obtaining transportation, be empowered to change the location of the meeting to the place receiving the second highest vote.

Motion seconded and carried.

President.—Gentlemen, the result of the first ballot is as follows: Total number of votes cast 58; Salt Lake had 30; New York, 14; Milwaukee, 14; total, 58. I therefore declare the next place of meeting to be Salt Lake City, Utah.

Mr. Cummin.—I move that Milwaukee be the second choice.

Motion seconded and carried.

Mr. Cummin.—I move that we now proceed with the election of officers.

President.—We will now listen to the nominations for the various officers, which are as follows:

President, J. H. Markley; first vice-president, R. H. Reid; second vice-president, J. P. Canty; third vice-president, H. Rettinghouse; fourth vice-president, F. E. Schall; secretary, S. F. Patterson; treasurer, C. P. Austin; executive members, W. O. Eggleston, A. E. Killam, J. S. Lemond, C. W. Richey, H. H. Eggleston, B. J. Sweatt.

Mr. Cummin.—I move that the assistant secretary be empowered to cast one ballot for all of the persons nominated.

President.—This does not prevent any member from making any nominations from the floor for any other member. It has been moved and seconded that the assistant secretary cast one ballot for the election of these officers. I think this requires the unanimous vote of the convention.

All in favor of that motion please manifest by show of hands; those opposed by the same sign. It is so voted.

President.—The assistant secretary has cast one ballot as directed, and I declare the nominees duly elected.

All those present accepted the office to which they were elected.

President.—This completes the list of officers. Mr. J. H. Markley, will you please take the chair? You have been duly elected president of this Association, and in handing you this gavel, I bespeak for you the same sympathy, courtesy and kindness which have been extended to me, and for which I feel very grateful.

President J. H. Markley.—In accepting this office as president of the Association, the highest which you can bestow upon any of its members, I feel that I have assumed a very responsible position. I feel it more so from the fact that in the past year I have been, and during the one yet to come shall be, burdened with work of more than ordinary responsibility. On this account, I have more than once tried to write my resignation, but I could not decide to do it, so I have concluded to accept this, with my other responsibilities. I hope I will not disappoint you in any respect. In regard to that, you will be better able to judge a year hence. In accepting this office, I feel somewhat as we do in our respective railroad duties, that we only succeed where we have the confidence and goodwill of our men. I realize and feel that my success depends very much upon you, and unless I have the full support of all the members of this Association, which I earnestly request, my success will not be all that I should like it to be. If at any time the members have any advice to offer, or suggestions to make, I assure them they will be thankfully received and heartily appreciated. (Applause.)

President.—In calling on the various members for chairmen of my committees, I hope they will not refuse to act. I intend to see as many of the members for chairman of the various committees as I can before the close of

this convention. If there is no further business to come before this meeting, we will adjourn, to meet next year at Salt Lake City.

President.—We will hold an Executive Committee meeting at seven o'clock this evening.

Secretary Patterson.—I would like to request that the chairman of the various committees arrange to have their reports sent to my office as early as possible, so that there will be time to have them printed in good season, and to have the advance copies distributed before the next convention. Some reports come in so late that this cannot be done.

Mr. Clark.—I would like to suggest to both our secretary and the chairmen of the different committees that in sending out their letters, they would be more apt to reach us if forwarded in sealed envelopes and marked "personal."

Mr. Cummin.—I move that we adjourn to meet in Salt Lake City, on the third Tuesday in October, 1907.

President.—All in favor of that motion please signify by saying "Aye," those opposed "Nay." The motion prevails and we stand adjourned, and I hope to meet you all in Salt Lake City next year.

S. F. PATTERSON,
Secretary.

W. C. KIKENDALL,
Official Stenographer.

COMMITTEE REPORTS

FOR 1906 AND 1907.

PRESENTED AT THE SIXTEENTH ANNUAL CONVENTION, BOSTON, MASS., OCTOBER, 1906.

I.

CONCRETE BRIDGES, ARCHES AND SUBWAYS.

(*No Report.*)

Discussion.

Mr. Reid—Mr. President, I was on that committee, but know of nothing done in the way of a report. We have been using a good deal of concrete for building purposes on the Lake Shore Road, including several good-sized arches, extensions to existing structures, and a good many abutments, piers and concrete culverts, with uniformly good success. On large structures, such as arches, abutments and concrete culverts, we are using reinforced concrete and steel rods to prevent any serious cracks. I think in any case where there is heavy traffic the concrete can be put in more cheaply than stone and in some places it is almost impossible to put in the stone; that is, because of the dense traffic it is impossible to handle heavy stone and keep out of the way of it, so we are forced to put in concrete, and, as I have stated, with good success. We have one arch, 163 feet, several of them seventy-five and eighty, and a good many other smaller ones, boxes of all sizes, also abutments of nearly all sizes.

Mr. A. S. Markley.—What do you use in making your concrete; gravel or crushed stone?

Mr. Reid.—On nearly all our work we use crushed stone; we have used some gravel concrete on some of our highway bridges, but for the heavy arches and heavy construction generally our standard is one part cement, three parts sand, and six of crushed stone.

Mr. Clark—I would like to ask Mr. Reid about the rods

used for reinforcement; that is, if he uses plain, round, square, or corrugated rods.

Mr. Reid.—We use the Johnson bar very largely, and the Ransom twisted; we use no plain bars. The Ransom, or corrugated rod like the Johnson, or any of those bars, will answer the purpose, and I think one is about as good as another so far as strength is concerned.

Mr. Alexander.—I would like to inquire what kind of cement Mr. Reid uses and if there is any great difference in the cement used in the concrete work.

Mr. Reid.—We have used probably a dozen or fifteen different brands. There are several good brands of cement: the Atlas, Sandusky, Universal, etc. Every car lot that comes to us is tested and must be accepted before it is used, and none of it is allowed to go into the work until the chemist has accepted it. We have rejections occasionally, but the cement companies are careful about furnishing good cement and if a carload does n't come up to the standard someone in the company is culpable. We had one shipment, of which there were two or three carloads, rejected, and the president of the cement company came up to see about it; but on the whole I think we have not more than five per cent. rejections, and possibly not over one per cent.

Mr. Schall.—I would like to have an expression of some of the members about the cracking of concrete walls. I believe some of the trouble is caused by having the mixture too wet; another cause may be in laying the concrete up very fast and exposing it to the atmospheric conditions or to the sun. This latter will, especially in the hot summer months, cause the face to dry and harden very quickly, while in the heart of the wall the concrete is not drying as fast; this produces an uneven shrinkage and will no doubt crack the wall at points. It seems to me that the manner in which the work is done and the protection afforded by keeping it wet on the exposed sides has some effect upon the cracking of the walls.

Mr. Heflin.—I think the question of the way in which

concrete is mixed is very complicated and practised by many people in different ways. It is now considered that good cement will take its initial set in about thirty minutes, and its real or permanent set would take three hours. The initial set is simply when the water has disappeared from the top of the concrete, and the real or final set in about three hours, when it becomes stiff. It is not altogether the matter of the cement; a good deal depends upon the degree of temperature. In cold weather of about forty degrees temperature you will find that a longer time is required before it sets, but when the temperature is about eighty degrees it sets very quickly and the work must be done rapidly; if not, it is apt to crack, as Mr. Schall says, on account of the outside becoming hardened before the inside does. We use a good deal of concrete for abutments and piers, and the proportion used for first-class concrete with us is one, two and four, but some of the work down in the bottom of the excavation we make the proportion of one, three and six.

Mr. A. S. Markley.—We have used concrete for abutments since 1893, and every year from that date we have put in more or less concrete, running up to many yards each year. We have never used any reinforced concrete until two years ago and all of the concrete that we built previous to the time of using reinforced rods we found perfectly satisfactory in every way. We have put up piers thirty-five and forty feet high, on which rest bridges of 160 feet span; these have proved very efficient, showing no cracks. In our double-track work, arches, etc., we have always joined our concrete on to the old work (either stone or concrete), and have torn down the old work only sufficiently to get a good bond, to which the cement would adhere

Mr. Alexander.—I am somewhat interested in this discussion. We, on the Bangor & Aroostook Railroad, have done a good deal of concrete work, and in comparison with the amount we have had very good results with our con-

crete. We have used broken stone and sand. such as has been described; we have used gravel mixed with sand in a proportion of about seven to one and it has proved very satisfactory. In doing this we have made a good mixture that is hard and stands well. We have built with this material without reinforcing, arches, but not any of the dimensions described; they are comparatively smaller—culverts not more than about fourteen to sixteen feet wide. A sixteen-foot arch is about as wide as we have, not reinforced; there has been no change in it; it is a very nice arch and a fine piece of work. We have in some cases reinforced with corrugated steel. I would like to ask Mr. Reid about the cement. We have had a supply lately that did not prove satisfactory and the question suggested itself to my mind whether Mr. Reid found any trouble with the different cements which he has used. We had one supply of cement which was unsatisfactory, it was so slow in setting.

Mr. Clark.—I would like to ask a question of Mr. Reid, or of any other gentleman, as to what they understand in regard to an entirely concrete ash pit resisting the action of fire and heat on the cement. Will a solid concrete ash pit stand the heat?

Mr. Reid.—We have very few concrete cinder pits under our locomotive tracks, but we have never had any serious trouble with them We built two last winter, and up to the present time there has been no trouble that I know of with the concrete from the fire or heat from the ashes, but I would not say that the concrete would not be destroyed if it became very hot and had water thrown on it. We have not had experience with concrete in very hot fires.

Mr. A. S. Markley.—At our shops at Oak Lawn we built, in 1902, a double ash pit, 250 feet long. We made no provision for expansion or contraction, and it has been in almost continual use ever since put in; there has been no trouble with the heat, but of course it has scaled off to some extent where the heat was very intense and water thrown on it, but on examination I believe that not over two and a

half inches of the concrete has scaled off, and this only at small intervals. By investigating the reports of the various engineers in the San Francisco and Baltimore fires, you will find them invariably favorable to concrete and that concrete withstood the heat better than any other material of which the buildings were constructed. In reference to wet and dry concrete, we use it very wet and try to keep all the air pockets out by continuous mixing and tamping. Care must be taken where uncompleted work stands any length of time; impurities, clay, etc., will float on the surface and settle as it dries out at this point. This should be made rough with a wire broom or rake and all impurities thoroughly washed off. A small amount of these impurities distributed throughout a large area is practically unnoticed and no evil will result from them; it is where these impurities concentrate that they cause defects, as well as improper bonding, to which concrete or cement will not adhere.

Mr. Clark.—What is the general system in mixing concrete?

Mr. Eggleston.—In speaking for the Erie road, there is a great deal of concrete work used in abutments, piers, etc., and, with one or two exceptions, I do not know of a failure. The general practice is to mix the concrete quite wet, and to keep it wet. I saw on the Western Division some abutments under highway bridges that were built several yars ago when it was something new with the men on that class of work; there was no water at the base of the abutments to draw from and the concrete was mixed a little dry; the weather became very warm and as a consequence, in a short time, they began to crack; they are badly cracked, and I think for no other reason than that the concrete was not kept sufficiently wet. As for expansion, I do not know of any effects of it, either expansion or contraction. On all the roads with which I have come in contact I have never noticed anything of that kind. The Lackawanna road is using great quantities of concrete in their main-

tenance of way department and from what I have seen there have never been any signs of defects. But this particular place of which I have spoken was certainly badly cracked and I attribute it to no other reason than that of not being mixed sufficiently wet.

Mr. Perry.—We have built a great many abutments for bridges and we find in very hot weather when we take the forms off it is best to wet the faces of those abutments and keep them damp until the same become set and hard. Sometimes we continue to do this for a week or longer, and we have found it a very good plan

Mr. Eggleston.—At one place in particular on our line, near Newburg, the masons built a pier on a solid rock foundation; they kept it thoroughly wet until it was completed, and for several days after they finished the pier it was kept wet, and it seems to be as solid as anything that could possibly be built.

Mr. Robertson.—I am very much interested in the discussion of this concrete. We are using concrete very largely in California and we have found the same advantages from it that you have here. We have used it for a number of purposes, including bridges, arches, etc., for the last fifteen years, and we do not reinforce any of our abutments; we think it unnecessary. We have, in some of the larger abutments, used rubble stone of large dimensions, probably four cubes, and we put in our concrete very wet. We have also built a standard concrete culvert, from twelve to thirty-six inches in diameter, made in sections. We use those to a great extent and have had no failures. We do not have the frost to contend with that you have. We use our concrete quite wet, and we find better results from it than from dry concrete.

Mr. Montzheimer.—I think concrete construction for culverts and arches is coming into more general use each year. If plans of the various styles of culverts made by the members of the Association were sent in and such as are interesting enough were shown in the proceedings, it would result in much good to the Association.

President.—I think that is a very good idea, and if the members will supplement their remarks by forwarding these plans to our secretary, they will probably appear in the proceedings.

Mr. Alexander.—We have found in doing concrete work in very cold weather that it has been a great help to heat the water and the gravel and we have been doing this in our work in severe weather and with equally good results as are obtained in the summer.

Mr. A. S. Markley.—There is just as much danger in the ordinary hot sun as in an ordinary hot fire, so far as the result in concrete is concerned. In several cases where work had stopped, the concrete thoroughly set and then started again, and the sun had baked the surface; we built the new concrete on top of it, failing to prepare the surface properly, and it would leave a seam in the work. It is best to keep the work going as uniformly as possible until the entire job is done; this will make one solid mass. Precautions taken by keeping the surface wet and covered with sacks or similar material that will retain dampness will not in any way prevent it from adhering, providing it does not stand over ten or twelve hours. Beyond this limit considerable risk is taken.

Mr. Clark.—In regard to the question of placing boulders and large sized stone in the concrete, we have put them in with very good success. We destroyed an old stone abutment and allowed a good many of the old stones to be used in the new concrete abutments, but we did not allow any of them to come within twelve inches of the face of the walls, and not less than six inches from each other. The stone was perfectly wet, clean and ready to put in on a fresh batch of concrete, before any initial set, in order to make it set right. There was no trouble in doing this and we utilized the old stone and at the same time lessened the cost of the work.

President.—I would like to ask if the members consider that corrugated bars have any advantage over the plain bars.

Mr. Reid.—We use no plain bars at all. I think a plain bar will not stand the vibration and the jar of the passing trains. In a building the plain bars might possibly be satisfactory, but for railroad work, we do not consider their use advisable.

President.—There is one point that has not been brought out in regard to using bars, where it becomes necessary to use more than one bar in a long wall. Mr. Reid, for our benefit, might mention how much lap he gives those bars in putting them in the wall.

Mr. Reid.—In lapping the small bars, we generally give from four to five inches lap, and for large bars, about twelve or fifteen inches; that is, a one-inch bar from twelve to fifteen inches lap, and for a half-inch bar we allow probably four to five inches lap.

Mr. Alexander.—In regard to lapping bars, we have plans and specifications of a standard culvert furnishd by another road and adopted by ours. However, we had occasion to make some repairs, and when the masons went to make proper repairs we found the concrete was not as strong as if the bars had run farther back, as they scarcely lapped six inches, and he suggested, and I agree with him, that the bars should lap further. If the bars are to be lapped they should be lapped at least fifteen inches or more to give the necessary strength in the concrete.

Mr. Clark.—I would like to ask if the members know of any perfectly water-proof covering of concrete. We have a great many concrete structures, and out of all that we have there are only two which are water-proof. How can they be made water-tight over streets and in towns where the municipal authorities require it.

Mr. Reid.—The Western Indiana has some concrete floors that are apparently water-tight. I have noticed them when there have been hard and heavy storms, for several hours, without a drop coming through. I think that with good concrete for the actual floor surface to carry the ballast, they can be made absolutely water-tight. In fact, I know

the Western Indiana is making them water-tight and I think they will remain so.

Mr. Alexander.—I have seen advertised a water-proof cement, something to keep the water out, and I expected to hear about water-proof cement at this meeting. We have never used it and I cannot tell anything about it. We built a vault outside of an office building with a flat roof and reinforced with rails and then we put on a cover of twelve inches of concrete, made it rich and thought we had it water-proof. We also added a coat of tar and gravel, and still the rain comes through. The Rubberoid men say that if we had covered it with a prepared roofing that would have kept it dry.

Mr. Clark.—I think it is water-proof paint of which Mr. Alexander speaks. We have tried it, but not long enough to know if it is going to be a success.

Mr. Eggleston.—This is an important subject. I suggest that we make it one of the standing subjects for the future.

President.—The Committee on Subjects can bear this in mind.

Mr. Schall.—There is one question I would like to ask and that is, "How long are the forms to be left on the concrete?"

President.—I would like to hear from some one on this point.

Mr. Reid.—The length of time that the forms should be left on depends largely on the nature of the concrete, or rather the size. In the smaller work the concrete will set much more quickly, while in the large masses it may require a month or longer. On some of our masonry we have left the forms on two months after the masonry was completed, particularly on some of the large arches. Possibly it may not be necessary, but we do it to be absolutely certain that the setting will be perfect. In cold weather it is necessary to leave the forms on longer than in the summer.

Mr. Alexander.—In regard to keeping the forms on, I

agree with Mr. Reid, and would say, also, that in cold climates that the concrete put in in cold weather, the form should be left on until thoroughly dry, even into the early part of the spring. We have never taken them off until the concrete is thoroughly dry, and there is less danger of damage to it by leaving them on.

Mr. Aldrich.—I would like to ask if any one here has had any experience with the effect of salt water on concrete?

President.—I have made concrete with salt water and have found about the same result as with fresh, except that it sets a little more slowly.

Mr. Aldrich.—I wish to refer again to the subject of the effect of salt water on concrete. The city has a bridge at Dover Street which has a pier of concrete in the channel. It has been there some ten years, and as far as the tide rises and falls it is eaten back about eighteen inches; above and below the effect of the tide it is unimpaired. Will some one express an opinion in regard to this?

Mr. Reid.—It may be the action of the frost, or of the frozen water or ice in the channel. The frost cannot touch the pier below low tide, as it is protected at all times, but that part of the pier between the high and low tide is subject to the freezing, and I believe it is due to the action of the frost rather than to the salt water.

Mr. Alexander.—I am somewhat interested in this subject of the tide water cutting away the concrete, of which Mr. Aldrich speaks. I would like to see this work, if we have an opportunity. I would like also to refer to the matter of tèsting cement before using it. We had a case where the contractors put in some walls by contract, and of course it did not affect the company; they received that which they considered good concrete, and after the forms had been on long enough for the concrete to set, possibly four to five days, they took the forms off and the wall fell down in places and they were obliged to put in new concrete. On those on which they allowed the forms to stay longer, until they were reasonably well set, they had bad results,

so I think it is important that even though we have first-class cement that the form should be allowed to remain long enough for the concrete to become thoroughly dry and set and in so doing you will get the best results.

Mr. Killam.—I do not have anything to do with construction on the Intercolonial Railway, excepting to inspect the work after it has been completed. But in many localities along our line we have salt water streams, where years ago the masonry was first class and of good material, as it appeared then, but the stone is now beginning to dissolve. We have a number of bridges where the masonry of the abutments and piers has been repaired with concrete. We also have some on dry land where we used concrete, and in no place where the concrete was used, where it was dry, is there any sign of decay. In regard to the question of reinforcing, I wish to speak particularly of one or two structures which were reinforced with barbed wire. I do not know whether any one here has ever used that kind of reinforcement. We had an abutment which was about forty-five feet high, by thirty feet across the front, and thirty-two feet back. It was getting into very bad condition and we put barbed wire and concrete all around the abutment, in front and on two sides; that was some five or six years ago, and there is no evidence of cracking from the bottom to the top. I do not know exactly how much barbed wire was used, but a considerable quantity was required and it is a perfect job at this time. We built last year two arches seventy feet long, 8 x 10, but not reinforced, and these arches are in perfect condition.

Mr. Reid.—I think Mr. Killam has discovered a use for barbed wire, or, at least, the only good place in which to use it.

Mr. Lichty.—I would like to say that most of the discussion comes from about a half dozen members. There are others here who are fully as competent, who might give us the benefit of their experience.

Mr. Montzheimer.—I think, Mr. Chairman, the discussion

of the subject is very good, of course; but it has taken up a great deal of time, and a committee making a report could have covered all these points, and would have accomplished more good than by discussing it among ourselves. I should like to ask what experience, if any, the members have had in the use of limestone screenings instead of sand in concrete. We have used the limestone screenings with good results.

Mr. A. S. Markley.—In replying to Mr. Montzheimer relative to the use of limestone screenings, I think the utility of limestone screenings depends altogether upon the amount of clay in the limestone, or the amount of clay dust that comes out with it. If the screenings were selected and free from clay, they would probably be satisfactory; otherwise I think they would be objectionable for the purpose.

Mr. Reid.—The limestone should be fairly clean. If dust and dirt or clay appear, bad results will follow, but if it is reasonably clean you will get very good concrete.

Mr. Lichty.—I would like to ask Mr. Montzheimer if there is any great amount of dust in the limestone, and if so, should it be left in?

Mr. Montzheimer.—I have never noticed dust in them. The screenings vary from about one eighth of an inch to the size of a grain of sand. And the main question was this, whether other people in using limestone screenings have been as successful as we have been.

President.—If there is nothing further to be said on this subject, we will pass to the next subject.

II.

EXPERIENCE AND USE OF CONCRETE AND TIMBER PILES.

No Report.

President.—In reference to this subject of concrete piles, there is one statement I would like to make to the convention and that is, that the Simplex Concrete Pile Company is doing some work of this kind here in the City of Boston, over at the N. Y., N. H. & H. R. R. freight yards. They were about to finish the work this afternoon of driving their last pile. This they have deferred doing for the benefit of this Association and have arranged to finish tomorrow morning at eight o'clock. If any of these members and gentlemen are interested in this matter they can witness the driving of that concrete pile by the Simplex process. It will take only about fifteen minutes to go, and I would suggest that those interested in the matter arrange to leave the hotel about eight o'clock in the morning

Mr. Reid.—Personally I would be very glad to go and see that work. I would like to ask how they drive these concrete piles.

President.—The Simplex system consists of a steel tube to which is fixed a detachable pile point, this tube is driven into the ground, filled with concrete and is then lifted up. This forces the concrete down below the end of the tube and also keeps the dirt and earth from filling in. We have here a representative of the Simplex Concrete Piling Company and he can tell you more definitely than I can relative to this matter.

Mr. Shuman (representative of the Simplex Concrete Piling Company).—Your president has given you a correct impression of our system. An open tube, the bottom end

of which is fitted with a loose cast-iron driving point, is driven into the ground until the proper penetration has been reached, after which it is filled with plastic concrete. The tube is then pulled out again, leaving the cast-iron point below, the concrete flowing out through the open lower end of the tube and filling the hole solidly with concrete, under great pressure. I am glad to have the opportunity to let you witness the operation of our system, and I think it will be of mutual benefit. We have practically finished that piece of work, having driven some 200 piles there. They averaged thirty feet in length, and the last pile by a strange coincidence was to have been driven this afternoon, but I happened to arrive in season to have the work of driving it withheld, so that you will have an opportunity to see the operation, and I will be glad to meet you here in the morning to accompany you.

President.—Is there anything further to be said on this subject?

Mr. Cummin.—I think it would be a good idea to defer further discussion until after we have seen the Simplex process of driving concrete piles.

III.

CONCRETE BUILDING CONSTRUCTION.

No Report.

Mr. Heflin.—I wish to speak in regard to concrete buildings. We have a number in our section and we use different forms of concrete. There are blocks of different shapes of five by nine or ten inches, others are square, and there are still others that represent rubble stone; they are made hollow and laid up like stone. We have the first story of many buildings made of this, and some frame houses which are veneered with concrete blocks; others are made of solid walls of concrete blocks, which make a handsome building, and it may be termed fire-proof.

President.—Are there any others who wish to say anything on this subject? There certainly must be others here who have had experience in the use of concrete buildings, and we will be glad to hear from them.

Mr. Reid.—I have not had any experience, personally, in the use of concrete for building purposes on the Lake Shore Road, but there are several buildings under construction in Cleveland and in other localities near there, and during the erection of one large concrete building the floors fell under their own weight, and several persons were more or less injured; they did not sustain their own weight. There was another building, which was to be used as a very large manufactory, where the floor and a large section of the wall fell under its own weight and several people were killed, and I have heard of several others which were failures. Now this does not demonstrate that a concrete building is not practical or safe if designed properly, but it does demonstrate the necessity of very careful calculation and accurate planning before such a building is commenced.

Mr. Parker.—We have at Los Angeles quite a number of

large concrete buildings, six and eight stories high. I never heard that any of the floors fell in. In fact, there was one building which I have in mind, in which, after the building was nearly completed, a large quantity of cement was piled on one of the floors, open to inspection, so that we could see the amount of weight that concrete would carry. A great deal of that kind of construction is being carried on in Los Angeles. The Santa Fé Railroad, of which I am a representative, is now constructing a freight house, 1,200 feet long and 60 feet wide, composed entirely of concrete, roof and all. A portion of the building is two stories high; it is a very substantial building, the work being done by contract; it is reinforced heavily with the Johnson corrugated bars; and no one has ever been heard to speak doubtfully of its durability in any point.

Mr. Snow.—In connection with this matter of concrete buildings, I would like to say that there is a very interesting example at Beverly on the Eastern Division of the Boston & Maine Railroad, about one half hour's ride from here. This building belongs to the United States Shoe Machinery Company. The original building is 400 feet long and three stories high and was built about a year and a half ago, of concrete; the walls, floors and roof are all of the same material. This summer an extension of this building was decided upon and at the present time an addition of 400 feet is being made. If any of the members wish to visit this building, I will be glad to furnish a guide to take them out there. I will say, also, between here and Beverly there is another building, which is being constructed of concrete, where the walls are of blocks, which are cast separately and put in place by the same method as is used in placing stone blocks, and this, also, can be visited easily on the same trip. There are a good many other instances of concrete buildings, but that one in Beverly is really the most interesting that I know of in this vicinity.

Mr. Killam.—Mr. Reid has corroborated my fears in regard to the safety of some buildings on the Intercolonial

Railway. These are our new machine shops. They are to be built of concrete. The car paintshop is to be 135 feet wide and 360 feet long; the walls, roof and floors are to be made of concrete, and the idea has occurred to me that there may be some difficulty in making the roof strong enough to support its own weight. Our new deputy minister advocates strongly the use of concrete. He assures us that it will prove reliable, and he is an engineer of long standing. The builders, also, are confident that it will be safe and durable. There are no gutters provided for running off the water which comes down over the roof. I would like to hear more concerning defects in buildings of this kind.

Mr. Cummin.—The defects of which Mr. Killam speaks come from two causes: One cause Mr. Reid has demonstrated in his remarks in reference to the calculations not being made with sufficient care. And the other cause, to my mind fully as fatal, is that sand is cheaper than cement. Now only a few weeks ago a large automobile garage, a building made of concrete, collapsed, killing three men and injuring a number of others. The concrete used in that structure would not pass the inspection by any member of this Association. There is another trouble that is coming up in regard to concrete; there are a number of machines made which anyone can purchase and by means of them establish a concrete block industry. I know of one individual who is making blocks by the hundred, who was once a butcher, cutting up meat in a butcher's shop; he is now organizing a stock company to manufacture concrete blocks. I have seen blocks standing outside of his place, the corners of which could be broken off with the fingers; and this poor material is to be used in concrete building. However, there are a number of large structures built of concrete, one near the Brooklyn end of the Brooklyn Bridge, an eight-story factory, built exclusively of concrete, and it is one of the most substantial buildings in the city. There are other splendid buildings of concrete. We have on our

road three small stations built of reinforced concrete, on an elevated structure. They are standing very well. We have been running electric trains by them every few minutes and have failed to find any defect in either of these buildings as yet. I think the defects are usually found to arise from one of these two causes: The calculation not being properly made, or that sand is used because it is cheaper than cement.

Mr. Killam.—In all the concrete used on our railway of some 1,500 miles in length, we employ river-washed gravel. This sand and gravel is taken from rapid streams and hauled to the different sections of the road, and we are also very careful to see that the crushed stone is mixed with that in the right proportion.

Mr. Clark.—I would like to ask Mr. Reid if the Lake Shore Company manufacture concrete whistling posts, and if so, what is their method of constructing them.

Mr. Reid.—We make them ourselves and I see no reason why they should not last indefinitely after being set up, unless they are broken by accident. They are made in a mould like the blocks, are three and one-half inches thick, twelve inches wide, and are set about five and one-half feet above the ground. I think they would not be very expensive if made in quantities. I think they would not cost any more, or very little more at any rate, than the wooden posts; they do not require paint. The letters and signs are cast right in the post; those are blackened at the time and will have to be blackened from time to time, but the post itself will not require any paint.

Mr. Clark.—We have recently placed about forty-five concrete fence posts as a test. These posts cost, after having been put in place, forty-four and one half cents. I think that price could be cheapened a great deal if they were to be made in quantities. They are made five inches square.

Mr. Reid.—Do you have wires put in for connecting your fences?

Mr. Clark.—Yes, sir. Wires are built into the post, projecting as a rule every four inches, for the purpose of being fastened to the fence with a pair of pliers. We put the woven wire fence on the back of the post and fasten it to the wires coming out of the posts. Also, some posts are made with a three-eighths-inch hole through the posts, where they are used for built-up fences, that is, fences made in the field. Holes are spaced to accommodate the style of fences required.

President.—Are your posts reinforced?

Mr. Clark.—Yes, sir, with small rods. There are four one-quarter-inch rods.

Mr. Lichty.—Do the rods run the entire length of the post?

Mr. Clark.—Yes, sir.

President.—If there is nothing further to be said on this subject we will consider the discussion concluded.

EXPERIENCE AND USE OF CONCRETE AND TIMBER PILES.

(*Continuation of discussion on Subject II.*)

President.—Now, gentlemen, if you have any remarks to make on this subject, Mr. Shuman of the Simplex Concrete Pile Company is present and will be glad to answer any questions in regard to the driving or use of concrete piles.

Mr. Reid.—While I was at the works this morning I noticed that the head of the piles were not finished, and I would like to ask how the piles are finished at the top.

Mr. Shuman.—We can finish the top of a pile in any desired manner. The concrete readily adapts itself to any of the conditions necessary, just as does any other concrete masonry.

President.—Has any other member any remarks to make or any questions to ask in regard to this matter?

Mr. Eggleston.—I would ask Mr. Shuman the approximate cost per foot of the piles when in place?

Mr. Shuman.—The cost of concrete piles will usually average from eighty cents upward. On one occasion, when we had a very large piece of work, with exceptional facilities for moving, they cost sixty-five cents. A great deal depends on the number, length and layout of the piles. You must realize in comparing the cost of wooden and concrete piles, that our concrete piles are sixteen inches in diameter from top to bottom, and hence have twice the side area of a wooden pile, and five times the bottom area, because the wooden pile has such a small diameter at the point. We generally allow as many as thirty tons weight on a pile. Sometimes we will only permit twenty-five tons, as much depends on the condition and kind of soil encountered. In New York City, at Broadway and Beaver streets, a very large twelve-story building was put up on Simplex

piles and in that case the building authorities allowed thirty-three tons per pile. We have frequently tested them with sixty and seventy tons without finding undue settlement.

Mr. Reid.—I would like to ask whether these piles are driven by the Concrete Pile Company in all cases, or whether they can be driven by the railroad companies, on a royalty, and if so, what is the rate?

Mr. Shuman.—The company itself does not do any driving. Our system has been to sublet throughout this country to concrete contractors for doing the work in their own locality, and each one has the sole use or right to put in the piling in that territory. But in cases where the railroads insist upon doing their own work, that would be a question for them to take up with our licensees, and it is probable that some arrangement could be made by which that could be brought about; but the Simplex Concrete Piling Company itself does not do any actual construction.

Mr. Cummin.—I would like to inquire in regard to the piling of which Mr. Shuman speaks in New York City, where they allowed thirty-three tons to a pile. Did those piles go down to rock bottom?

Mr. Shuman.—In that case we drove through a bed of quicksand until we struck gravel. There is no method of determining beforehand how long a pile will be. It is entirely a question of what is encountered in the driving; my recollection of that particular piling is that we went down into a very compact gravel.

Mr. A. S. Markley.—I would like to ask Mr. Shuman if he has had any experience in regular trestle work, such as is commonly used by the railroads, and what method he employs in doing that class of work?

Mr. Shuman.—Yes, we have done that by making a temporary mold; in other words, build the pile up above the surface, by using a sheet iron or a wooden mold.

President.—Is there anything further to be said on this subject; if not, we will pass to the next one.

Mr. Shuman.—Before the discussion on this subject is closed. I would like to make a few general remarks. The wooden pile has made a good form of foundation for ages past, and will continue to be used for years to come, but it must give way very substantially to the concrete pile. Timber is rapidly becoming more expensive, and there are large movements in progress having for their object the preservation of our forests. Our first concrete piles were driven in 1903, and in the short time that has elapsed since then we have extended the business all over this country, and are using this method of pile driving in England, France and Germany today. It has been a great pleasure to me to make the acquaintance of the members of your honorable body and I thank you for the courtesy shown me.

President.—If there is nothing further to be said we will close this subject and take up the next in order.

BUILDINGS.

(Continuation of discussion on Subject No. III.)

Mr. Mills.—We are making a good many concrete platforms on the New York Central Road, which we consider very good. We commence with about eight inches of cinders, then we place on that about three inches of concrete, consisting of one part cement, three of sand and six of stone; it has a top dressing of about one inch of concrete made in the proportion of one to two. This makes a good concrete platform and costs about thirteen cents a square foot. Of course, the curbings are of concrete and go down below the frost line.

President.—Does the cost of the platform include that of the curbing and all?

Mr. Mills.—Yes, sir.

President.—How wide is the platform?

Mr. Mills.—Ordinarily the width is from eight to ten feet. Narrow platform curbing should be figured extra, to cast about thirty cents per lineal foot.

President.—Have we anything further to add under the head of concrete building construction?

Mr. Lichty.—This is an important subject and I suggest that it be carried over to be reported upon next year.

President.—Is there anything further to be said on this subject? If not, we will pass to the next subject, number four.

IV.

METHOD OF WATERING STOCK IN TRANSIT.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

Your Committee, after sending out a number of circular letters of inquiry, find that it would be impracticable to specify any one particular outfit which would be suitable for all localities and deem it advisable to give extracts from circular letter issued and replies received thereto.

EXTRACT FROM CIRCULAR OF INQUIRY.

Your Committee on subject No. 4, "Method of Watering Stock in Transit," begs leave to request your assistance in getting up an intelligent report to be submitted to our Association at their meeting to be held in Boston, October 19, 1906.

1. What method do you use in watering stock in transit? This to include both cattle and hogs, also upper and lower decks for hogs.

2. What methods do you use in sprinkling or drenching hogs during hot weather?

3. What provision do you make for watering stock at feed stations? Give kind of power generally used for pumping water, when taken from wells, also description of troughs used.

4. What per cent. of your stock pens are supplied with water?

5. What is the usual distance between water tanks you have equipped for drenching hogs, or watering stock?

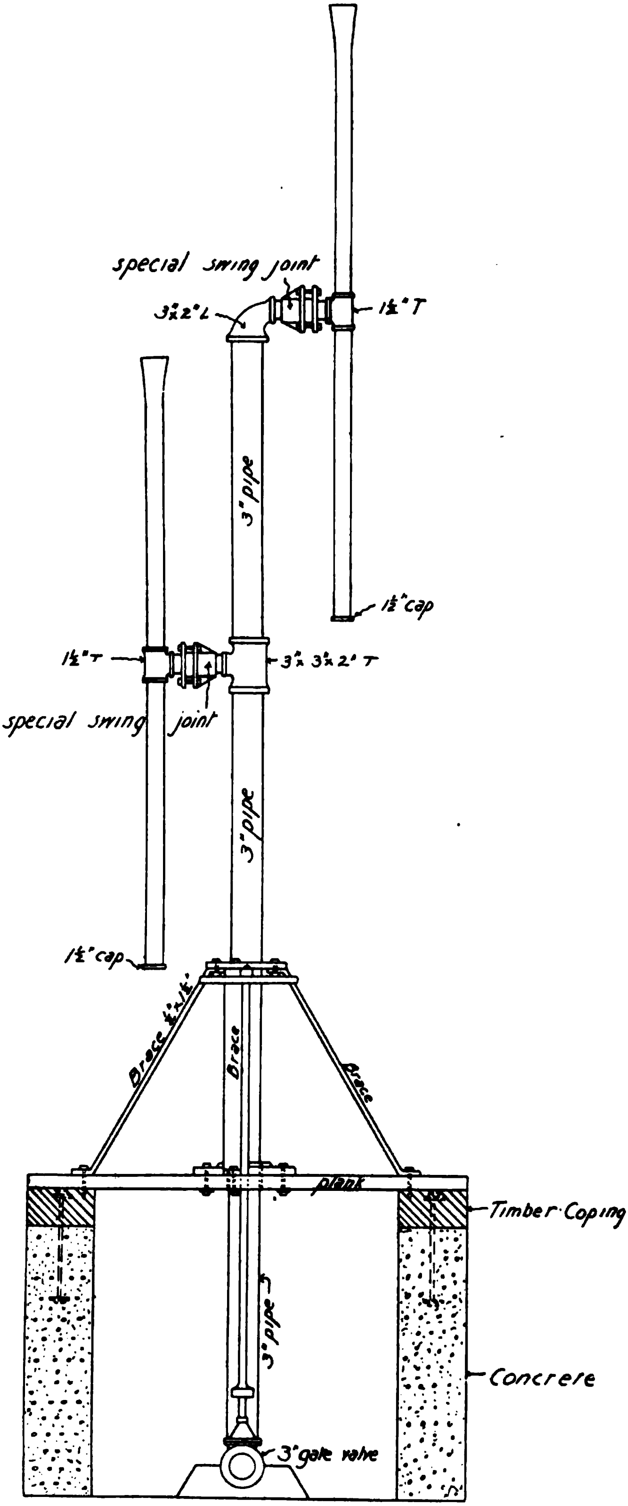
EXTRACTS FROM LETTERS RECEIVED IN ANSWER TO CIRCULAR OF INQUIRY.

H. H. Eggleston, Supervisor Bridges and Buildings, Chicago & Alton Railway Company:

1. We water stock and hogs in transit with hose connected to discharge pipe at water stations. At terminals we also have three or four connections of hose and water a train as train is moving slowly.

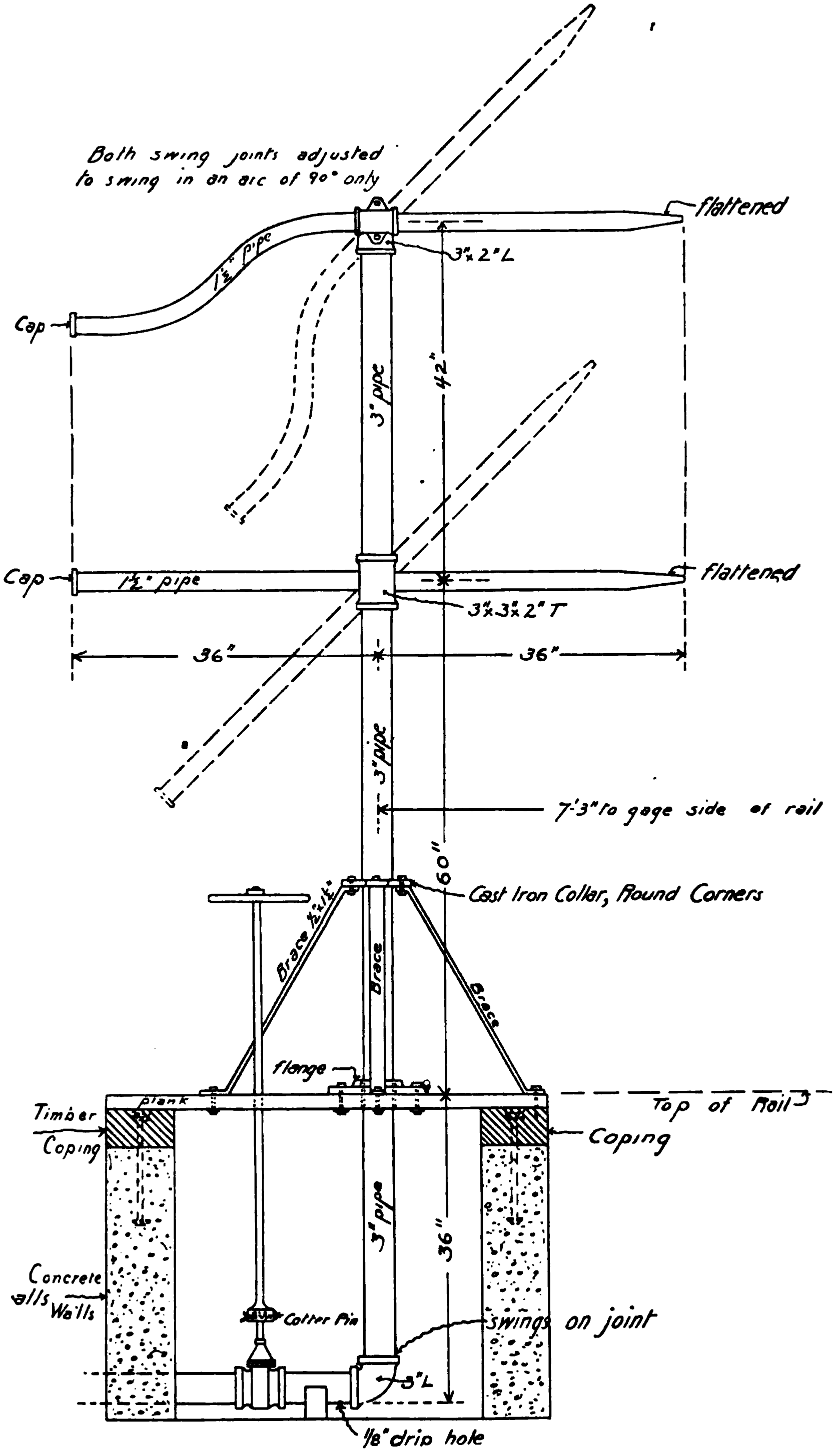
2. The same method is used to sprinkle hogs in transit and where water is plentiful the hogs are drenched directly from tank spout into cars as cars are moved past water tank. This cannot be done from water column or stand pipe.

3. At feed stations we have hydrants and hose connected, so we can put water in each pen. We use wood troughs 12 inches x 16 inches x 16 feet long. We use water from our water tanks where we have tanks. Where there is no tank and there is city water, we use city water. Where there is no city water or tanks, we use a three-inch force pump and hose.



Elevation, Parallel to Track, When not in Use.

Fig. 1.—Boston & Maine R. R., Standard Hog Drencher.



Elevation, Square to Track, Ready to Use.

Fig. 2.—Boston & Maine R. R., Standard Hog Drencher.

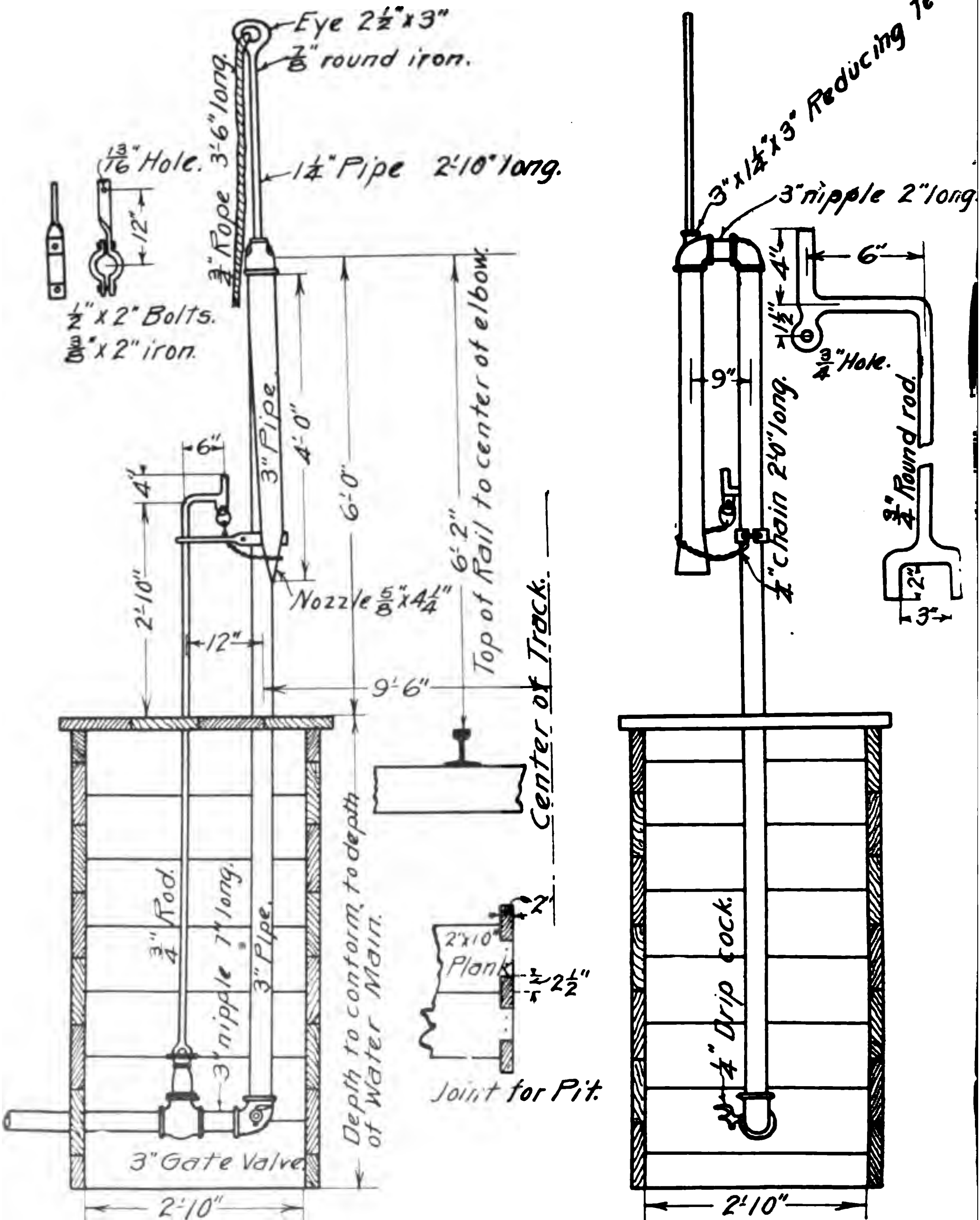


Fig. 3.—C. & N. W. Ry., Standard Hog Drencher.

4. All our stock pens are supplied with water in some manner, either from water tanks, city, or pumps.

5. Average about 15 miles between water stations and all are equipped for watering stock.

J. P. Canty, Supervisor Bridges and Buildings, Boston & Maine Railroad:

1. Cattle in transit on the division where I am located are unloaded and watered in yards. Hogs are drenched in the cars at various points along the road.

2. We use a device as shown on attached blueprint for drenching hogs on cars in transit. You will note that this permits throwing water on animals on the upper and lower decks at the same time.

3. At the feed stations cattle are driven into pens and watered in the customary way from troughs. Steam pumps deliver water in some places from wells into elevated tanks, from which the troughs in yards are supplied by gravity. In other places water is supplied directly by gravity from springs or town water mains. Troughs are made of 3-inch spruce plank firmly bolted together to form a box of the customary dimensions and joints are caulked with oakum.

4. At all of our cattle yards where stock is cared for in transit every pen is supplied with water.

5. Distance between hog drenching stations vary as conditions necessitate, from 25 to 50 miles. Our watering stations for cattle in transit are located only at the eastern end of line and at the several points where connections are made with western roads. The last mentioned places are from 100 to 225 miles from the eastern terminus.

Enclosed blueprint shows details of standard hog drencher.

W. C. Hasley, General Foreman Bridges and Buildings, Chicago & Northwestern Railway Company:

1. Blueprint shows plan for watering stock in transit and same device used for filling troughs in cars.

2. Same plan describes our hog slushers.

3. We make water troughs out of three pieces of 3 x 10 inches x 12 feet pine bolted together, with ends of same size lumber. Have tank and wind mill at all stock yards. (Gravity water from these tanks to yards.)

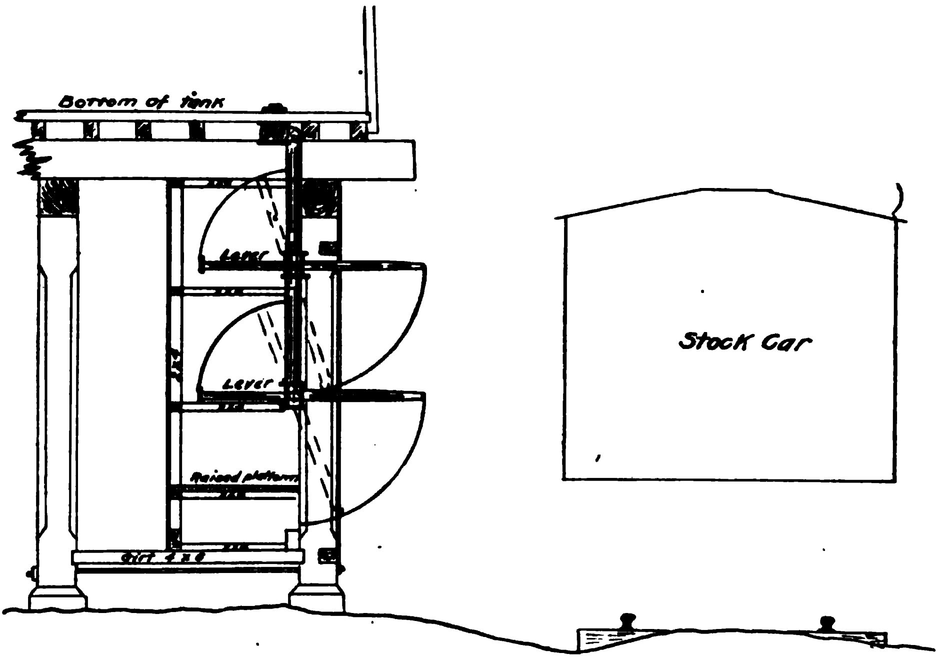
4. Ninety-five per cent. of pens are supplied in this manner.

5. About 40 miles between drenches.

Blueprint enclosed herewith.

A. Shane, Superintendent Bridges and Buildings, Toledo, St. Louis & Western Railroad Company:

1. At stations where we have pressure sufficient we have a hydrant with a hose attachment.



Cross-section Drencher Room.

Fig. 4.—T., St. L. & W. R. R., Standard Stock Drencher. Bridge and Building Department, Frankfort, Ind., August 24, 1906.

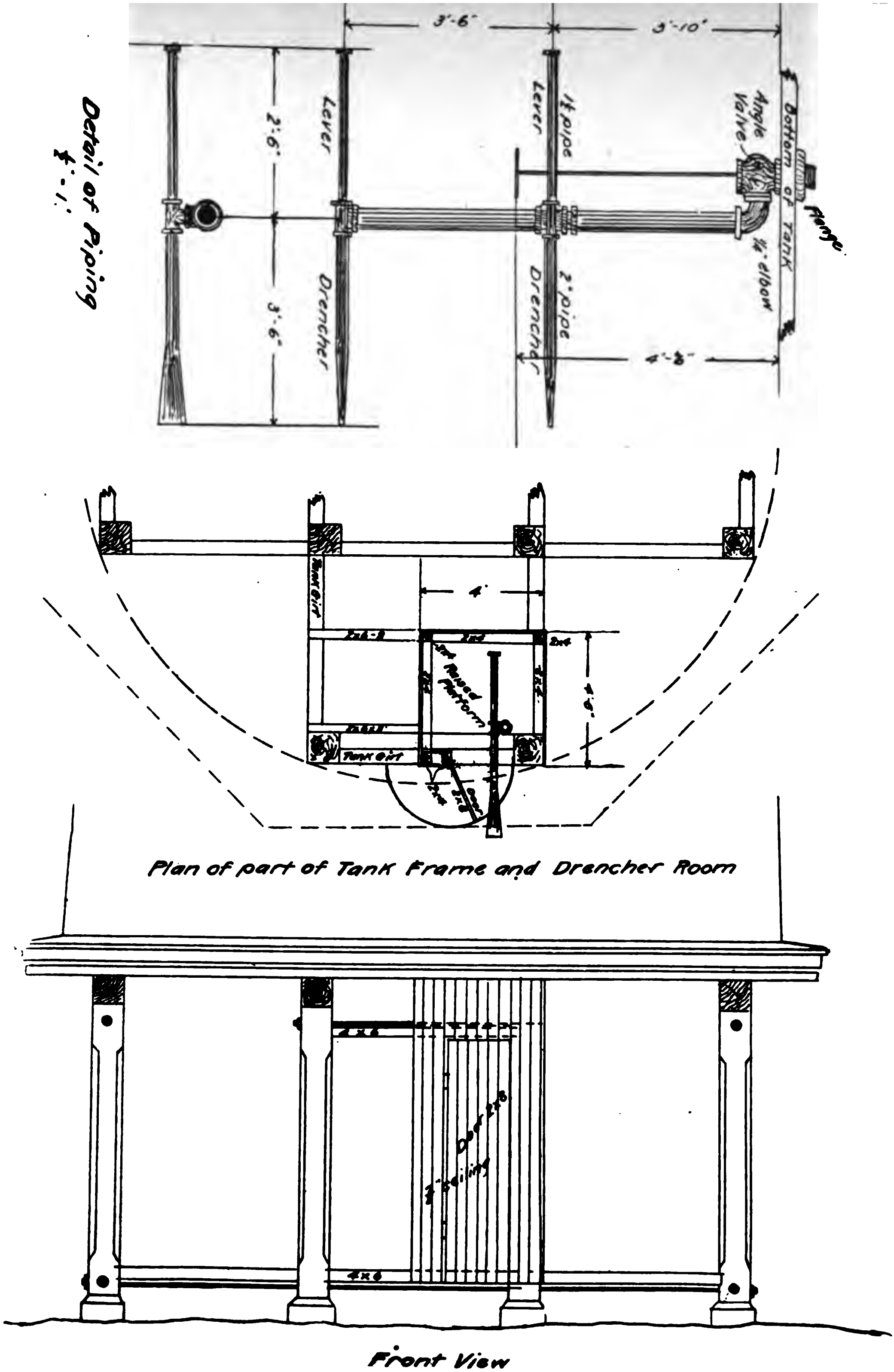


Fig. 5.—T., St. L. & W. R. R., Standard Stock Drencher.

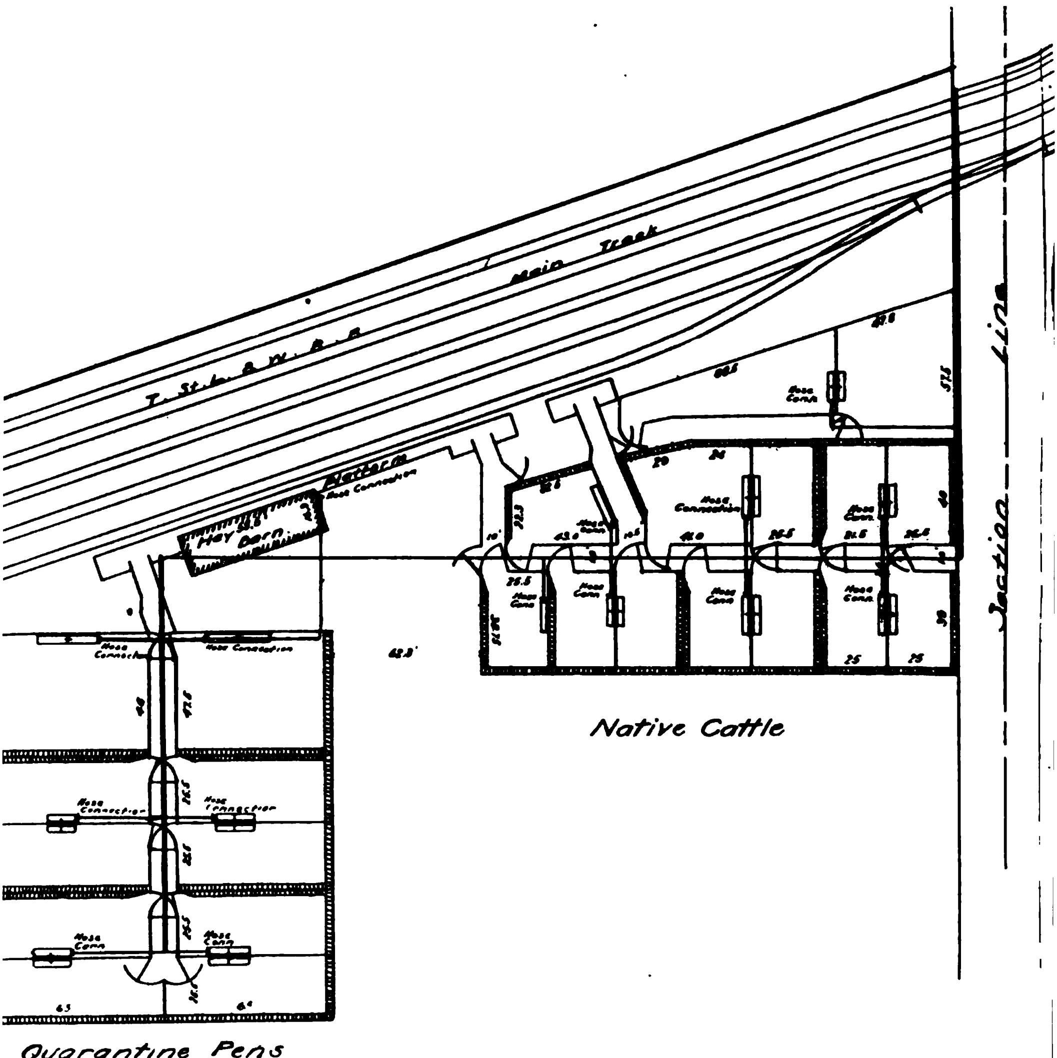


FIG. 6.—T., St. L. & W. R. R., Cattle Pens.

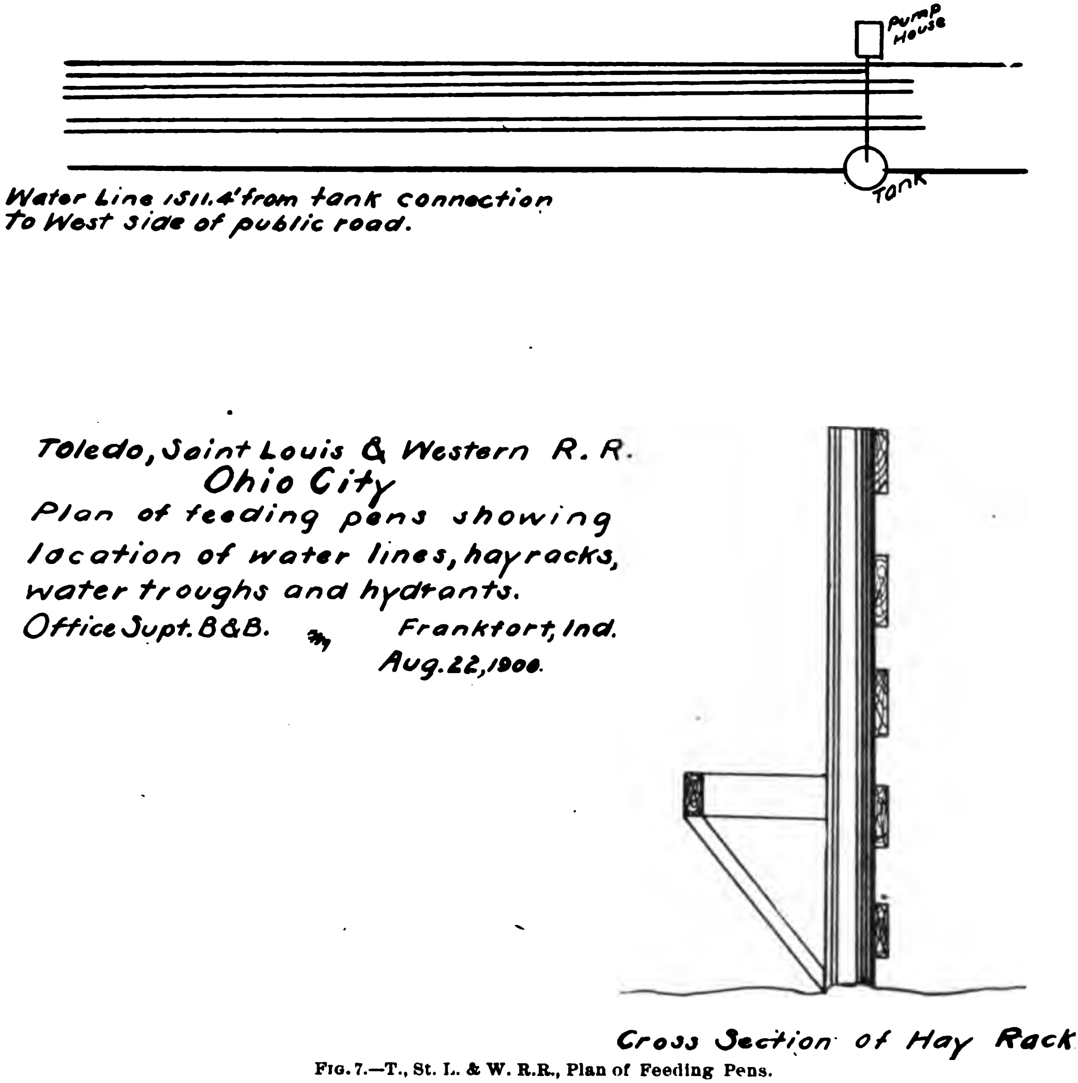


FIG. 7.—T., St. L. & W. R.R., Plan of Feeding Pens.

2. Tracing shows method for drenching hogs in transit.

3. Tracing shows our stock feeding and watering pens at Ohio City. In each of these pens we have at least 100 feet of rack for hay and a 16-foot watering trough. These troughs are supplied from our watering station, as shown on tracing, through a 2-inch main which connects with our 4-inch discharge pipe. Valves are so arranged that we can pump direct to the pens or get a supply by gravity from the tank. Our hydrants are so arranged that each one supplies two pens, and we have pressure sufficient to keep the troughs all full with 10 or 12 cattle drinking from each trough.

Two tracings enclosed herewith.

J. T. Carpenter, Supervisor Bridges and Buildings, Southern Railway Company:

1. At each water tank we provide a 1½-inch hose connection to the supply pipe under the tank. We also furnish about 25 feet of hose, which is stored in frost-proof box and locked with switch lock, so trainmen can get it at any time for watering stock.

2. Same device as No. 1.

3. We have but one feed station and use city pressure. We have two troughs in each pen, one at the ground for hogs and sheep, and one above it for cattle.

4. About 25 per cent. of our stock pens are equipped with ordinary hand force pumps.

5. About 19 miles.

O. H. Andrews, Superintendent Bridges and Buildings, St. Joseph & Grand Island Railway:

1. We usually unload them.

2. We use an inch and a quarter hose, 25 feet long, attached to the water pipe under our track water tank. We also open tank valve and water hogs out of the outlet pipe, through the side of the car.

3. We use steam, gasoline and windmill power in pumping water at feeding stations. Our troughs for watering sheep are made of 2-inch plank, 12 x 12 inches x 12 feet. Cattle troughs are made of 2-inch plank, 12 x 20 inches x 16 feet long. Hog troughs are made of 2-inch plank, 12 inches deep x 10 inches on bottom, 14 inches at top x 16 feet long.

4. They are all supplied with water.

5. The distance between water tanks which are equipped for watering stock and drenching hogs is from 15 to 25 miles.

M. R. Williams, General Foreman Bridges and Buildings, Atchison, Topeka & Santa Fé Railway Company:

All the stock shipped over this division is unloaded, watered and fed at each division point. We have feed yards at Albuquerque, Las Vegas, Raton and La Junta, and the stock are un-

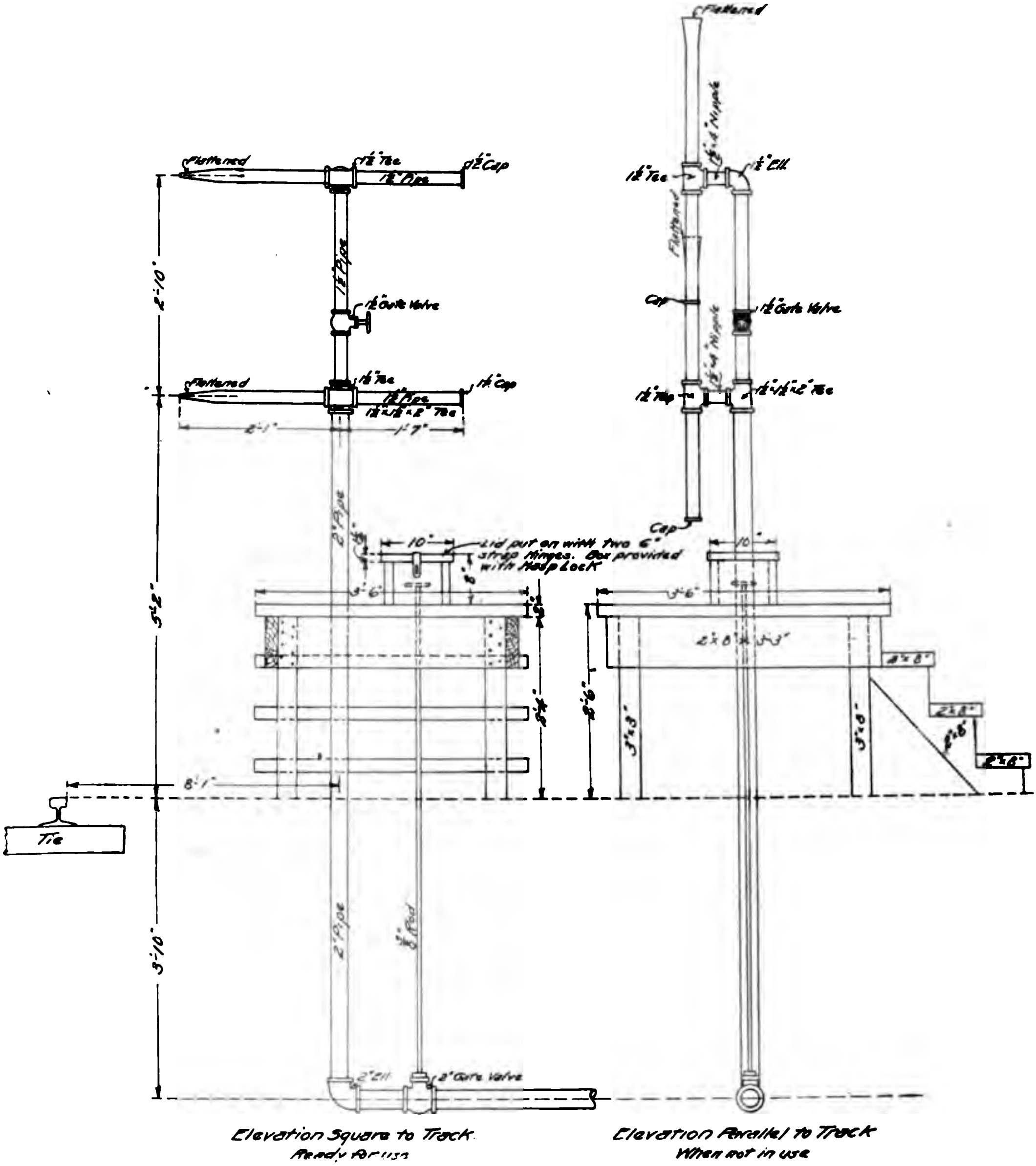


FIG. 8.—L. E. & Western R. R., Hog Drencher.

loaded at these stations, fed and watered and reloaded and shipped on.

At Albuquerque we have a gasoline engine and pump, which furnishes water from well, and have water troughs in each feed pen.

At Las Vegas the feed yards are three miles from the city, and what little watering we do we haul it in water cars, empty it in pipe line, through which it runs into troughs in feed pens by gravity.

At Raton we have a gravity pipe line seven miles up the mountain that furnishes water at the stockyards.

At La Junta we have windmill and well.

Stock are shipped over this division in stock cars furnished with water troughs on the sides, and if stock need water before reaching a division point these troughs are filled from our steel tanks. All tanks on this division are steel, and we have a hog-wash in connection with 2-inch hose to reach to cars.

S. F. Clapp, General Foreman Bridges and Buildings, Gulf, Colorado & Santa Fé Railway:

1. No provision is made on this line for watering stock, either cattle or hogs in transit. In case any water is taken for this purpose, it is taken from the goose neck of tanks, flooding the cars.

2. It is a matter of flooding by use of the goose neck.

3. At all feeding stations, stock pens are equipped with water troughs and pipe lines throughout the pens. These pipe lines are connected direct with the water tank, or city pipe lines, as the source of water may be. At one point on my division, San Angelo, we have stock pens, well, windmill and tank, and the pipe lines are connected direct from the tank to the troughs. The troughs that are used are made of red cypress, 15 inches in width at the bottom and about 22 inches on the top, with a depth of about 13 inches.

4. About 25 per cent. of our yards are equipped with water and troughs.

5. No stations equipped for this purpose. But very little stock, especially hogs, are handled in this territory, stock shipments being largely cattle, with a small amount of sheep.

SUMMARY OF INFORMATION RECEIVED IN ANSWER TO COMMITTEE'S CIRCULAR OF INQUIRY.

We find where any fixed appliance is provided for watering and sprinkling stock in transit, that the plan furnished by the Boston & Maine Railroad, also the Lake Erie & Western Railroad seem to be the most feasible, the advantage being on account of frost-proof box, which protects the pipe in freezing weather and is easily closed and abandoned during the winter months. The hose with connection to supply pipe is a very convenient appliance, but a little expensive, on account of it not always being well taken care of. Only about 50 per cent. of the roads heard

from have any appliances for this purpose. Ten per cent. of the roads heard from depend entirely on goose neck in the water tanks for the supply, these being roads that do not handle stock extensively and where water is a small item. Two roads report having abandoned this feature and returning to the old plan of watering stock from goose neck. About five per cent. of the roads heard from do not handle stock enough to give the subject consideration, their business being freight of a different character.

The Committee desires to call attention to the tracings furnished by the B. & M., L. E. & W., T., St. L. & K. C., and the C. & N. W. railroads.

J. N. PENWELL, *Chairman,*
U. A. HORN,
M. R. WILLIAMS,
C. F. KING,
G. E. POWERS,
J. C. TAYLOR.

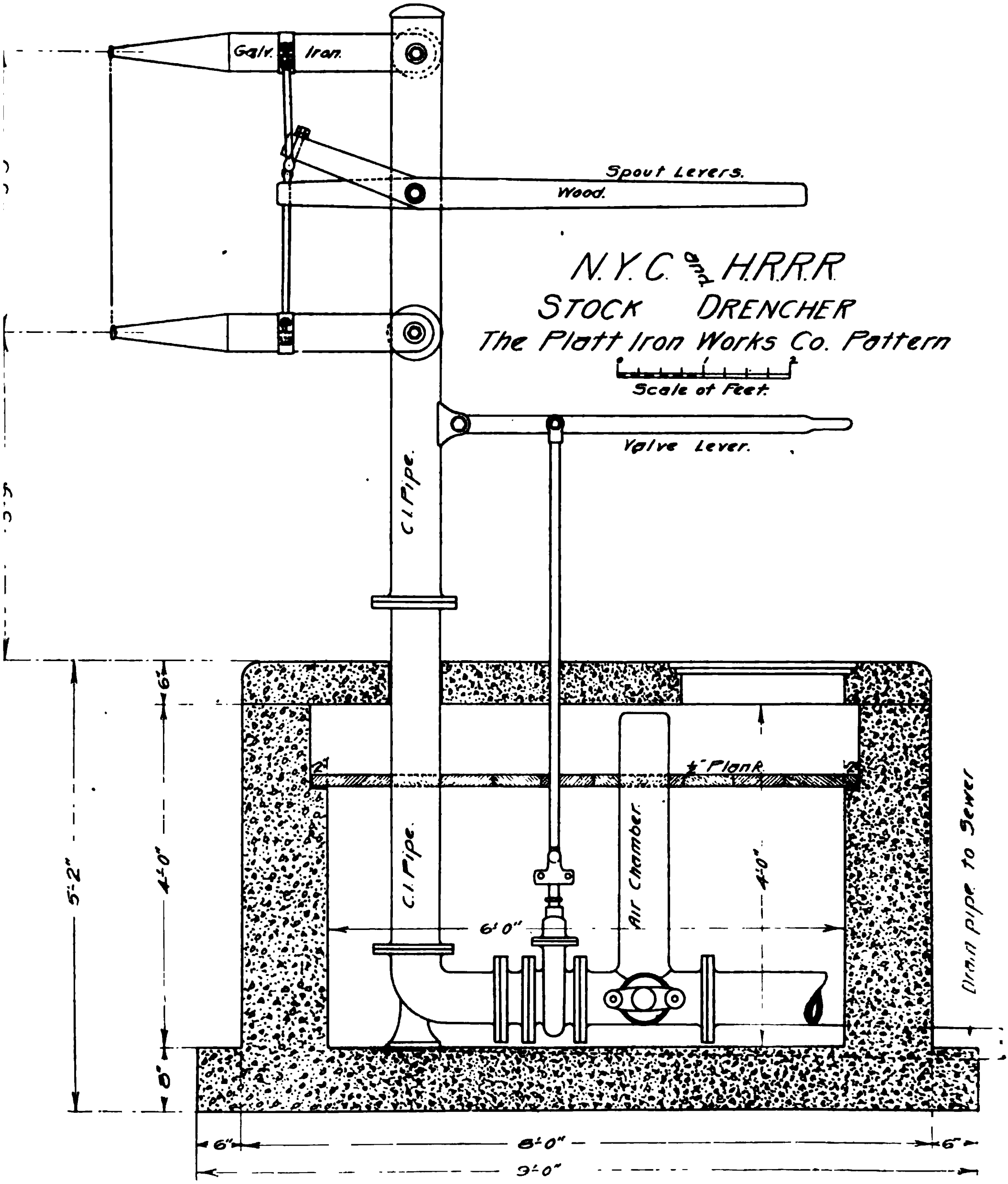


FIG. 9.—N. Y. C. & H. R. R. R., Stock Drencher.

SUPPLEMENTARY REPORT.

W. A. Pettis, General Supervisor of Bridges, New York Central & Hudson River Railway Company:

1. There is no successful way of watering stock in transit. The small iron troughs in the stock cars hold such a small amount of water that it is a waste of time to fill them. The only way to water cattle is to yard them at terminals. Hogs obtain some benefit while in transit by drenching and get enough water to keep them from perishing. Hogs are more susceptible to suffering than cattle or sheep.

2. All stock from the West is unloaded at Buffalo, yarded, fed, watered and rested before reloading. After hogs have had sufficient rest they are reloaded and corn is placed in the troughs in the car, and if car is not equipped with troughs the corn is thrown on the floor, and after the train is made up it is run very slowly by the water station and each deck of the car is drenched with a three-inch hose. The other hog-drenching points are equipped with the double spout drencher. These spouts are three feet, three inches apart and can be placed at any angle and with ordinary tank pressure, if the train moves slowly, the hogs can be thoroughly drenched. This method is very effective and is far superior to the use of the ordinary hose.

3. At feed stations, or terminal points, cattle are placed in yards about 45 x 45 feet, furnished with hayrack and water trough. The hayrack has a roof over it. Water trough is about 26 inches wide at top and 20 inches at the bottom and 16 feet long and 24 inches deep. This is made of 3-inch cypress. The entire plant is furnished with water mains with branches to each, though furnished with stop and waste placed 4 feet below the surface to prevent freezing.

Hogs are housed and placed in pens about 35 feet x 35 feet, with floor feed troughs and water troughs. Water pipe to each trough same as used for cattle. Size of the hog troughs 20 inches wide at top, 16 inches at bottom, 12 inches deep and 12 feet long.

Sheep are housed, and the pens are similar to those used for hogs. Method of watering, the same.

Water at feed stations is furnished by city pressure. At hog-drenching stations water is taken from regular 50,000-gallon tanks. The power at water stations is either city pressure, steam or gasoline. All hog-drenching stations are placed at regular engine watering stations.

4. The only stockyards supplied with water are the terminal and feeding points. Every station has a small stockyard, but they are not supplied with water, as the stock is kept in these small yards for only a few hours.

5. Average distance between drenchers about twenty-five miles.

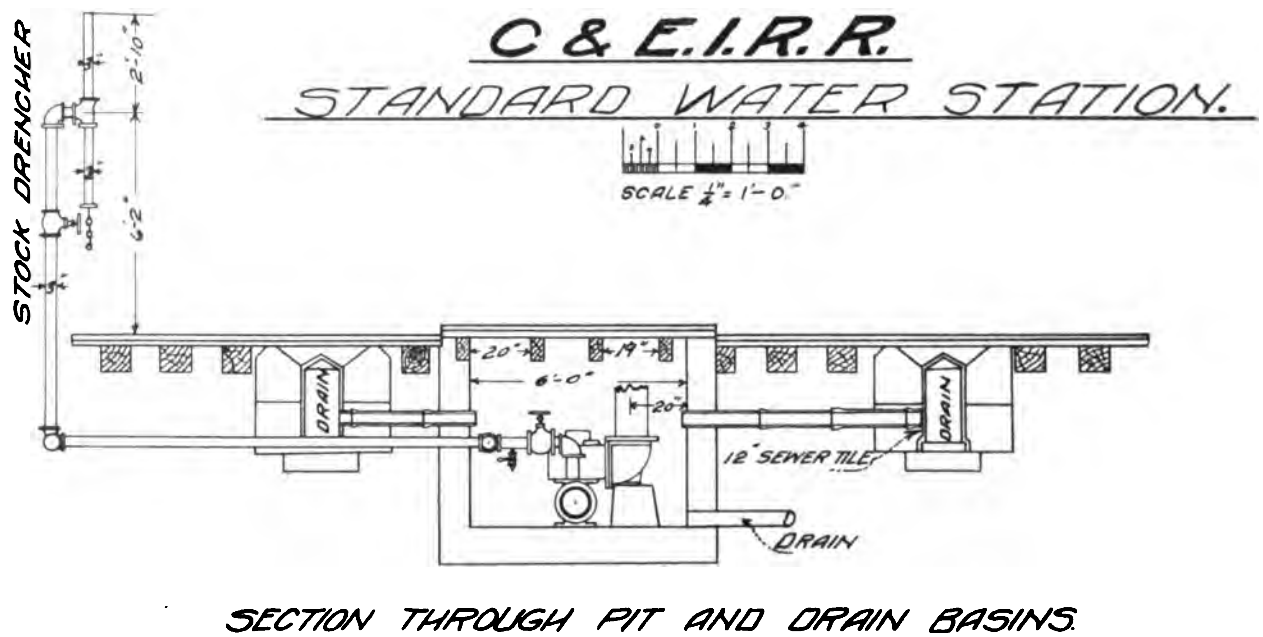


Fig. 10.—C. & E. I. R. R., Standard Water Station.

Mr. R. H. Howard, Engineer Maintenance of Way, Chicago & Eastern Illinois Railroad Company:

Referring to your circular letter of August 1, subject No. 4 "Method of Watering Stock in Transit," to be submitted to the Association at Boston in October, 1906. Our method of watering stock in transit is through a 3-inch gas pipe connected either to the tank or in the standpipe pit, the horizontal section being about six feet above the ground, on which is connected a nozzle pivoted in the center, which enables the stock men to spray water over the stock in cars as desired. The valve below the nozzle is so located as to be manipulated from the shield and the water turned on to the stock. Inside of the standpipe pit or frost box of the tank, a plug valve is located to shut off water and drain pipe in the winter season between December 1 to February 1.

Attached find blueprint of our arrangement, which is placed at all of our important points for watering stock. We have no feed stations on our line. Seventy-five per cent. of our stations have facilities for watering stock in pens before loading.

DISCUSSION.

Mr. Reid.—The method of watering stock does not come under my charge, but in connection with that matter I will say that we have at various points on the road an arrangement, constructed of six-inch pipe, with a nozzle pipe about three feet long and flattened to a chisel shape with an opening of about one and one-half by about six inches wide, the idea being to throw a flat stream of water between the slats of the cars. We have two of these at each place, one for the upper and one for the lower deck. They are very similar to some of these shown here in the report.

Mr. Lichty.—The Lake Erie & Western Railroad Company shows the two spouts and the flattened nozzle in the printed report.

Mr. Reid.—Ours are six-inch pipes.

Mr. Lichty.—It is customary to use three-inch pipes.

President.—Have we some further remarks on this subject? If not, we will pass on to the next subject,as our time is becoming limited.

V.

RECENT PRACTICE IN COFFER DAM WORK.

REPORT OF COMMITTEE.

READVILLE, MASS., August 23, 1906.

To the Association of Railway Superintendents of Bridges and Buildings:

Your committee on subject number five, "Recent Practice in Coffer-Dam Work," beg to submit the following, which is all I have been able to get from 25 circular letters which I had printed and sent out to 25 different members of the Association. I was asked at rather a late date to take this matter up, as several other members had been asked to serve on this committee and had declined on account of other pressing business.

Personally I have but very little information to give on this subject.

1. I have never used any steel sheet piling, neither have I seen anybody else using it.

2. We use spruce from 3-inch to 4-inch grooved on both sides for a spline to be about ⅛ of an inch wider than both grooves. This is done to make a tight job. In very hard driving we would use 6-inch hard pine grooved in the same manner as mentioned above.

3. The 3-inch spruce we usually drive by hand with a large wooden beetle; the thicker plank we usually drive with a pile driver when we can get at it. Sometimes when we cannot get to the desired position with a pile driver, we have used a derrick by attaching a pair of leaders or guides to the end of the boom to guide the hammer, and have driven pile sheeting where we could reach with our derrick. To pull the sheet piling we use a pile driver, or derrick, if we can get at it. If the resistance is not too great we pull it by hand, using a strap of iron with a link attached to it to receive a bar or lever, as the case may be. In a good many cases where we think it will not pay to pull the plank, we cut them off at, or a little below, the ground level.

4. I cannot answer, as I have never had any experience with steel sheet piling.

EXTRACTS FROM CIRCULAR OF INQUIRY AND ANSWERS RECEIVED.

The Committee on Recent Practice in Coffer Dam Work requests that you answer the following questions:

1. What has been your experience with steel sheet piling; can you drive it in all kinds of soil, and how many times can you use the same steel sheet piling?

2. What kind of lumber would you use if you were driving wood piling?

3. Best method of driving and pulling both wood and steel piling.

4. Relative cost between wood and steel piling.

J. P. Snow, Bridge Engineer, Boston & Maine R. R.:

Answering yours regarding "Recent Practice in Coffer Dam Work":

1. We have used no steel sheeting.

2. Three-inch or 4-inch spruce, if dam was not high or driving hard; 4-inch to 6-inch Southern pine if conditions were severe.

3. Pile driver.

4. No experience.

With timber sheet piling it does not pay to economize on thickness of plank. I prefer to groove the plank and use splines nailed into one groove. The spline should be soft wood, either spruce or white pine; and it should be thin enough to enter the grooves easily and wide enough so that it will hold the planks ⅛-inch apart. This will make a tight dam when the planks are set together accurately.

If plank cannot be driven to make the bottom tight, I prefer two lines of planking filled with earth.

The Proceedings of the eleventh Convention, 1901, pages 42–68, contain valuable matter on this subject.

W. M. Clark, Master Carpenter, Baltimore & Ohio R. R.:

Answering yours of July 24, regarding "Recent Practice in Coffer Dam Work":

1. I have had no experience with steel sheet piling, but from observation I think steel piling can be driven in all kinds of soil, and, as the number of times this piling can be driven depends largely on the care exercised in driving and pulling, it is good until either split or bent.

2. I would use a cheap quality of wood, such as hemlock, beech or maple, as I find them as good for the piling as the more expensive woods.

3. I think the best method of driving sheet piling for heavy work is with a block fitted in a small pair of leads, same as a pile driver or, where practical, use a pile driver. For light work use a wooden maul, driving by hand. The best form of piling is made by using three pieces of plank 12 inches wide spiked together, the centre plank set back from the face three inches, thus forming a tongue and groove piling. I have no method of pulling steel piling, and for wood, use cheap material and leave the same in, unless it can be pulled easily with chain and lever.

4. Can give no relative figures as to the cost between wood and steel piling.

J. F. Lantry, Supervisor Bridges and Buildings, N. Y. C. & H. R. R. R.:

Noting your letter of July 24, with committee circular, subject number five, "Recent Practice in Coffer Dam Work":

1. We have never used steel sheet piling on this or any other division on which I have worked, so that I cannot give you any definite information in regard to it.

2. We use yellow pine for wood piling, made up in Wakefield style, planks, 2, 3 and 4 inches thick, according to length of pile used. The longer the pile, the heavier the material.

3. We use an ordinary land pile driver, with a cast iron hammer for driving our sheet piling. We generally use a hydraulic jack in pulling the first pile or two if they start heavy, and the balance we pull with a 30-foot steel rail used as a lever.

4. As we have never used steel sheet piling I cannot give you the cost of this, but as for the wood sheet piling, ordinarily a pile 20 feet long made up of three pieces, of 3 x 10 x 20 feet long in place costs about $6.66, or about $8 per lineal foot. This price, of course, varies according to length of pile and the kind of material through which we have to drive..

Moses Burpee, Chief Engineer, B. & A. R. R.:

Replying to your circular, subject number five:

1. No experience.

2. Spruce.

3. I have seen light sheet piling driven successfully with steam drill, using a light hammer.

J. N. Penwell, Supervisor Bridges and Buildings, Lake Erie & Western R. R.:

In reply to your circular letter relative to subject number five:

1. We have never used any steel sheet piling; have seen them in use recently but am not sufficiently acquainted with their merits to answer this question.

2. We use oak, hickory, beech or hard maple for sheet piling. Oak and hickory preferred, as they are stiffer and will stand more driving.

3. If the driving is not too heavy we drive them by hand with wooden mauls. If the piling must be driven ahead of the excavating, so this method is not practicable, I would use a very light pile driver. The hammer should not weigh to exceed 1,200 pounds.

If a pile driver is in use and convenient to reach the piling, this is a very good way of pulling sheet piling, otherwise a derrick should be used. This applies to cases where the job is large enough to justify the use of the hoisting engine. If only a small job and there is already a bridge to hitch to, they can be pulled more economically by hand, using tackle blocks.

4. Am not prepared to answer this question intelligently on account of lack of experience with the steel sheet piling.

W. M. Noon, Superintendent of Bridges and Buildings, D., S. S. & A. R. R.:

Answering questions contained in your circular on subject number five, "Recent Practice in Coffer Dam Work":

1. I have never used any.

2. I generally use pine or oak timber. It depends on the kind of soil encountered and also the kind of timber we can get. Norway pine makes a very good wood piling.

3. I have never used sheet piling enough to make any suggestions on the driving of it and have never pulled any after it has been driven.

4. I cannot say.

R. J. Arey, Division Engineer, Santa Fé Railway:

1. Have had no experience with steel sheet piling, and none has been used during the twelve years that I have been on this division.

2. Have used in practice native pine timber, also Oregon pine, as plain sheet piling and also tongue and grooved.

3. I have found in practice that a good method in driving wood piling is by means of a pulley with a large block of wood, or a small hammer, either operated by manual force or by horse power.

4. In my judgment, wood piling is, or has been up to the present time, cheaper than steel piling. Lumber costs about $20.50 per thousand, BM, wale pieces about the same. I regret that I cannot give you any data on the subject of steel sheet piling.

The A., T. & S. F. Ry. are driving some sheet piling this year on the San Joaquin Valley Division and will have some data later on the subject.

A. E. Killam, Inspector of Bridges and Buildings, Intercolonial Railway of Canada:

1. We have not had any experience with steel piles on the I. C. R. When the road was built I think in all cases piles were 8 and 9 feet double row, 3 and 4 feet apart, tamped with clay between.

2. Piles made of spruce are found to be the best.

3. We drive with steam-driven hammer, 18 to 24 cwt., for wood piles. Have not used steel.

4. No experience.

Along the Intercolonial Railway of Canada the pile driving done is nearly all for temporary use, such as staging, for putting up new bridges and other temporary work.

J. T. Carpenter, Superintendent of Bridges and Buildings, Southern Railway Company:

I have not had any experience in coffer dam work or sheet piling, and am therefore not in position to give you any information on such work.

G. Aldrich,
Committee.

Supplementary report by F. W. Bailey, Superintendent of Bridges and Buildings, M., K. & T. Railroad, through Mr. W. F. Steffens, member of the committee.

DENISON, TEXAS, October 8, 1906.

F. W. Bailey, Superintendent Bridges and Buildings, Missouri, Kansas & Texas Railway System:

Your favor to Mr. Fisher has been handed to me for reply, beg to advise we have had no experience with concrete piling.

We have sufficient Friestadl steel piling in 36-foot lengths for most any kind of abutment or pier work; have used it now on different pieces of work twice on the Canadian and once on the Brazos River. In the first instance we had about 15 feet of water and 20 feet of quicksand; in the last instance we had about 15 feet of water and had to go 60 feet for foundation, the last 24 feet was quicksand. Experienced no difficulty in driving, used a jet and on the first two jobs used drop hammer; on the last one used steam hammer; in each case drove the steel piling six inches or more into the rock foundation. After using the piling, I had them straightened and they are as good as new.

As to spacing wales: that depends wholly on the material and its consequent pressure. We framed in 12 x 12 timber about 8-foot centers at top and 4-foot centers at bottom at Brazos River; we put in timber casing and sunk same about 30 feet, then drove the steel casing inside and framed in walls as we went down with excavation. In driving used hoisting engine and ordinary land driver with long leads, made a hood to go over ends of steel piles to protect same.

When timber is used for sheet piling we use long leafed pine, dimensions to suit requirements. We have found the difficult part was to draw the steel piles.

On the first job set up raising bent, rigged six set triple and double blocks with 2½-inch line, used two hoisting engines and two 35-ton Norton jacks, and it was slow and expensive work to pull them. We made some special clevises and drilled additional holes for bolts in the steel piling, as the single bolt would shear off with the strain we put upon them. The last two jobs we were on we thoroughly douped the piles, and were careful not to force them down, but rather depended upon the jet getting them down, but still they were difficult to pull.

I haven't the exact cost at hand, in fact, I do not consider the use of steel piling practical where timber casing will answer. They are especially adapted to foundations where quicksand is encountered and where, without their use, we would be compelled to use compressed air at a much greater expense.

SOUTH BETHLEHEM, PA., September 1, 1906.

Mr. G. Aldrich, Chairman, Committee No. 5, Association of Superintendents of Bridges and Buildings, Readville, Mass.:

DEAR SIR: I note below answers to your questions in regard to "Recent Practice in Cofferdam Work."

1. I have had no actual experience with steel sheet piling. Have made tests of driving such piling, and in my opinion it can be

driven in gravel free from large boulders; also in clay, sand and the softer materials. I think it will make a first-class cofferdam and foundation shoring. As to the pulling of sections for reuse, this can no doubt be done where driving is not too hard, but how many times steel piling can be used over again depends on the nature of the soil in which it is driven. It should be used at least four times to make its cost come within the cost of wooden sheet piling of 3-ply made of 1½-inch plank T. & G. form, but for foundations where quicksand is encountered the steel sheeting would appear to me the best, on account of the interlocking of the sections and small displacement of material by each section.

The kind of lumber used for wooden sheet piling where tightness of pit is necessary, I think should be oak, yellow pine or beech, depending again on the nature of the soil. It would also depend on what kind of lumber is to be had in the nearest market, suitable for driving. For ordinary shoring of foundations hemlock planking two or three inches thick should answer.

3. Steel piling can no doubt be driven best by means of a steam hammer; quick blows will do best work for driving this material; for pulling steel sheet piling I should use same overhead frame used for driving. Before starting to pull, each section should be tapped lightly with the steam hammer to jar section loose, then pull them with hoisting engine and strong tackle blocks.

4. Cost of sheet piling in wood 3-ply, 1½-inch plank driven to give same effect as steel piling, will probably be from 22 to 25 cents per square foot in place, while steel sheet piling 15-inch channels and Z-bars weighing together 41 pounds per square foot, cost about 2¼ cents per pound delivered, cost of driving say ⅛ cent per pound, making 2⅜ cents per pound, or 97⅜ cents per square foot; adding for creasing and burlap facing will make the cost about $1.00 per square foot, or four times as much as wood sheet piling, 3-ply.

Yours respectfully,

F. E. Schall.
Walter T. Berg.
E. B. Ashby.

DISCUSSION.

President.—We are now ready to proceed with discussions on number five. Mr. G. Aldrich of the N. Y., N. H. & H. R. R. is chairman, and I would like to ask Mr. Aldrich if he has anything further to suggest since his report was made and printed?

Mr. Aldrich.—I wrote to Mr. Reid of the Lake Shore Road, making inquiries of him upon the subject of "Steel Sheet Piling," and enclosing a circular bearing upon the same matter. I hoped and expected to have received from

him a report of considerable value. He states that he did reply to my inquiry at some length. I regret to say that his communication did not reach me; but as he is present, perhaps he will give us the benefit now of his experience and his opinion upon the subject of steel sheet piling.

President.—Would like to hear from Mr. Reid.

Mr. Reid.—Accidents will happen, and in some unaccountable manner my letter of reply to Mr. Aldrich's inquiry went astray. We have been using some steel sheet piling on the Lake Shore Road for coffer dam work, at Irving, N. Y., about twenty-eight miles west of Buffalo. We could not drive wood sheet piling, so we used steel sheet piling. We finally succeeded in driving them down, although it was hard work. We were obliged to go through sand and gravel, broken stone, boulders, old piles and timbers. We obtained a fairly water-tight result. The joints could be made reasonably water-tight in a moderate depth of water, but in deep water we had to bank with clay. It did the work and required very little inside bracing. For one pier we excavated about fifteen feet below the water. We also had a good deal of difficulty in removing them, and many of them we could not pull out at all. There must have been about a hundred that we could not get out. Of those which we did get out I presume we lost about thirty per cent., as about thirty per cent. were good for nothing but scrap. It is therefore a question which should be taken into consideration, whether it pays to use sheet piling in place of wooden piling. The steel piling we used weighed, approximately, thirty-five pounds to the foot and cost about $50 a ton.

President.—Are there any further remarks to be made? It is certainly very interesting.

J. H. Markley.—We are doing some of this work at Peoria just now, and have been for the last ten months. We are using the Wakefield Piling, made of 3 x 12 pine, surfaced on one side and bolted together with half-inch carriage bolts about three feet apart. In putting our dam

around the first pier, which is at the east end of a 287-feet draw, we were confronted with one of the worst river bottoms that could be imagined. We were working without any knowledge as to the nature of the old foundation, but supposed it to be piling; but I could not work on this supposition, that is so far as dredging was concerned, for fear of undermining the pier. By drilling through the pier from top to bottom, I found it rested on timber four feet below the river bed. As to whether the timber was supported on piling, or simply on the bed of the river, there were no records to show. When we finally got the pier all out we found it rested on sand and gravel, and was built in 1856. Some twenty-five years ago the river scoured around the pier; in fact, in some places it reached two feet below the foundation. In order to stop this, there were some twenty or twenty-five carloads of rubble stone put all around it, on the up-stream side. This bed of stone was ten feet thick, so you can imagine with what obstacles we had to contend. In order to avoid the stone I made the frame for the dam large enough to avoid as much of it as possible. However, with all of this precaution we could only get about one half of the piling down to bedrock. The balance rested on the rip-rap stone. This formed an ideal filter for the water under the staves and more than our pumps would keep out Our next movement was to fill the inside of the dam with clay, with the idea that it would settle in the voids around the rip-rap stone and then drive another dam and make it just as small as it could be made, allowing enough room to work between it and the old pier and for the pumps in one end. Those pilings under the bridge we forced down with jacks, the balance were driven with a 700-pound hammer. The leads of the driver were swung from the ends of the derrick boom. The cost of the wooden staves such as we used were about one half the cost of steel.

Mr. Heflin.—My method of building coffer dams is controlled entirely by the condition of the bottom of the stream where the excavation is to be made. If the water is shallow,

and the bed of the stream is about level, we use a 6 x 6, or eight-inch stringer inside and outside of the coffer dam, framed and doweled together at such height above the water surface as may be desirable. Around the frame we drive two-inch sheet piling on both sides, filling in with clay between the two lines of sheet piling. The piling is driven with a heavy maul or wooden hammer, the power being supplied by a small engine.

Mr. Killam.—On the Intercolonial Railway we have not had any experience in taking out old foundations. We always use the old foundations which have been in for fifty years or more. As to the forms or modes of coffer dams: In gravel bottoms or soft bottoms, where we have five or ten feet of water, and of no considerable depth, we drive two rows of piling around, six feet from the structure that is to be put down, and between these rows we tamp with clay. The piles are eight, ten or twelve inches wide and are driven with an ordinary pile driver, down to hard bottom, and then pump out the water and excavate, and the masonry is begun on a solid bottom. The bridge across the Grand Narrows, in Cape Breton, is 2,000 feet long, and there are seventy-six feet of water in the deepest part. The bottom was hard. Caissons were built and sunk, and the masonry was built in them. The masonry is perfectly solid yet. We had marine divers a short time ago to make an inspection to ascertain the state of the masonry, and found it was in good condition.

A member.—We have never used the steel sheet piling on my division, but we have used the wooden sheet piling in various thicknesses and it has answered the purpose admirably. We generally drive this Wakefield piling with a regular land pile driver.

President.—Have we any other remarks in connection with this report? If not, we will pass to the next subject, number six.

VI.

MODERN COALING STATIONS AND CINDER PITS.

REPORT OF COMMITTEE.

PROVIDENCE, R. I., Sept. 12, 1906.

To the Association of Railway Superintendents of Bridges and Buildings:

Your committee on subject number six, "Modern Coaling Stations and Cinder Pits," begs to report as follows:

After an exchange of views as to the best method to be adopted in gathering material for a report, a circular was mailed to 75 members of the Association, distributed over the United States and Canada, of which the following is a copy:

The undersigned committee request your assistance in the preparation of a report that will cover all important points in connection with this subject.

Will you, therefore, please furnish plans of coaling stations and cinder pits that are in successful operation on your road, with a descriptive letter accompanying each plan, pointing out the advantages and disadvantages found in practice, and including answers to the following questions, with reference to

COALING STATIONS.

1. How is coal handled? Whether from elevated trestle, dumping the coal from cars into pockets, shoveling from cars into pockets, link belt conveyor, or by locomotive crane from cars or storage pile.

2. Approximate cost of plant, giving some detail.

3. Capacity in tons per hour, and for each 24 hours.

4. Cost of coaling engines, per ton.

5. In your opinion, what is the best type for coaling stations having capacity of 50, 100, 300, 500, 1,000 and 5,000 tons, with reasons for same.

6. What kind of power do you prefer to operate the machinery of coaling stations? Whether steam engine, gasoline or electric motor.

CINDER PITS.

1. Description, whether depressed track for ash cars, link belt conveyor, swinging or traveling crane handling buckets.

2. Approximate cost of construction, giving some detail.

3. Greatest number of engines to be cleaned per hour, and average in each 12 and 24 hours.

4. Cost of handling cinders per yard.

5. If machinery is used, is it operated by same power that operates coaling plant?

6. In your opinion what is the best type of pit for handling ashes at stations where there are 5, 20, 50, 100 and 200 engines per day to be cared for?

Seventeen replies have been received, some of them very recently, and the majority of these were accompanied by descriptions, blueprints and cost data. Several reasons might be named why a larger number did not furnish the information requested, the principal one being that your committee was unable to get the work started until after the commencement of the busy season. Another was, that more than one department of the railroads are concerned in supplying the information desired, thus making it more difficult to obtain, and finally, a few roads objected to having information of that character published.

A letter was mailed on June 22, to all those who had not then responded to the circular, urging them to do so as quickly as possible, but only a few replies were received, some stating that the circular had not reached them.

While much valuable material is at hand which might be used in preparing a report, some of it is in such form as to render it difficult to tabulate, or draw conclusions from, and it is apparent in some cases that possibly only one division of an important road is covered, and this might not have in operation all the standards of the road. For this reason, and because more than one department is concerned, the returns would doubtless have been more complete if the request for information had been addressed to one of the general officers of the roads, whether represented by membership in our Association, or not.

In view of this situation, and the importance of the subject, in connection with the fact that the individual members of the committee have found it impossible to give the matter proper attention on account of other urgent demands upon their time, it has been decided best not to make a full report at this time, and recommended that the subject be continued for additional investigation by a committee.

With reference to the scope of this investigation, the committee of which Mr. W. A. McGonagle was chairman in 1901 and 1902, made an excellent report on "Auxiliary Coaling Stations" only, but the subject now under investigation does not appear to have been limited to one class of stations, and the committee would recommend that if the subject is continued, the Association define the scope of inquiry, as to whether it shall be confined to terminal stations only, or include all classes. The blueprints and other information received in answer to circular of inquiry are on exhibition for such disposal as may be decided upon.

Respectfully,

J. S. Browne,
Chairman.

G. H. Soles,
D. W. Lum,
F. P. Gutelius,
F. B. Scheetz,
Committee.

SUPPLEMENTARY REPORT.

COALING STATIONS.

J. P. Snow, Civil Engineer, West Somerville, Mass., Coaling Stations:

We have a modern coaling station at Ayer, Mass., which I will try to describe briefly and, if possible, I will fix up an outline drawing in season for use by Secretary Patterson. Our working drawing is too much in detail for your use.

The coaling plant at Ayer consists of a trestle 13 feet high, with two track hoppers built under it. These hoppers will each hold a carload. They discharge by a simple guillotine gate 2 feet square into a 1-ton tub, which is raised on a C. W. Hunt inclined boom to empty automatically into two elevated hoppers, 15 feet by 20 feet, holding each about 150 tons. These hoppers deliver to locomotives by four William's and White chutes, with Anderson controllable gates. There is no provision for weighing coal, as our people do not think it pays to go into the complication necessary. This plant is worked with one hoisting engine, so that but one tub is in use at one time. Thirty tons per hour is easy work. The measure of speed is getting the coal out of the cars.

We have two fairly modern styles of ash-pits, one of which is an air-hoist hung from a gallows frame, which spans the pit track and an ash-car track alongside. The ashes are dumped from the engine into a bucket in the pit underneath, the engine moved away and the bucket raised by the air-hoist and traversed over the car, where it is dumped and returned to the pit ready for another engine. The other is a pit with depressed car-track alongside. The engine track is elevated as much as circumstances will allow. I send you a print of this. It is the favorite scheme with us at present.

Charles Carr, Superintendent Buildings, M. C. R. R., Jackson, Mich.

COALING STATIONS.

1. We use all the methods mentioned except the last (locomotive crane from cars or storage pile).

2. Cost of plant (link-belt conveyor) $22,355.60, distributed as follows: Pit, $4,250.30; chute, $15,405.30; tracks, $2,700.

3. Five hundred tons per twenty-four hours, twenty-one tons per hour.

4. $0.0478.

5. Link-belt conveyor, for the reason of its being the most economical.

6. Electric motor when available; if not, a gasoline engine.

CINDER PITS.

1. Depressed track pit.

2. Cost of two pits, $5,277.84 (track work not included).

3. Average of eighty every twenty-four hours.

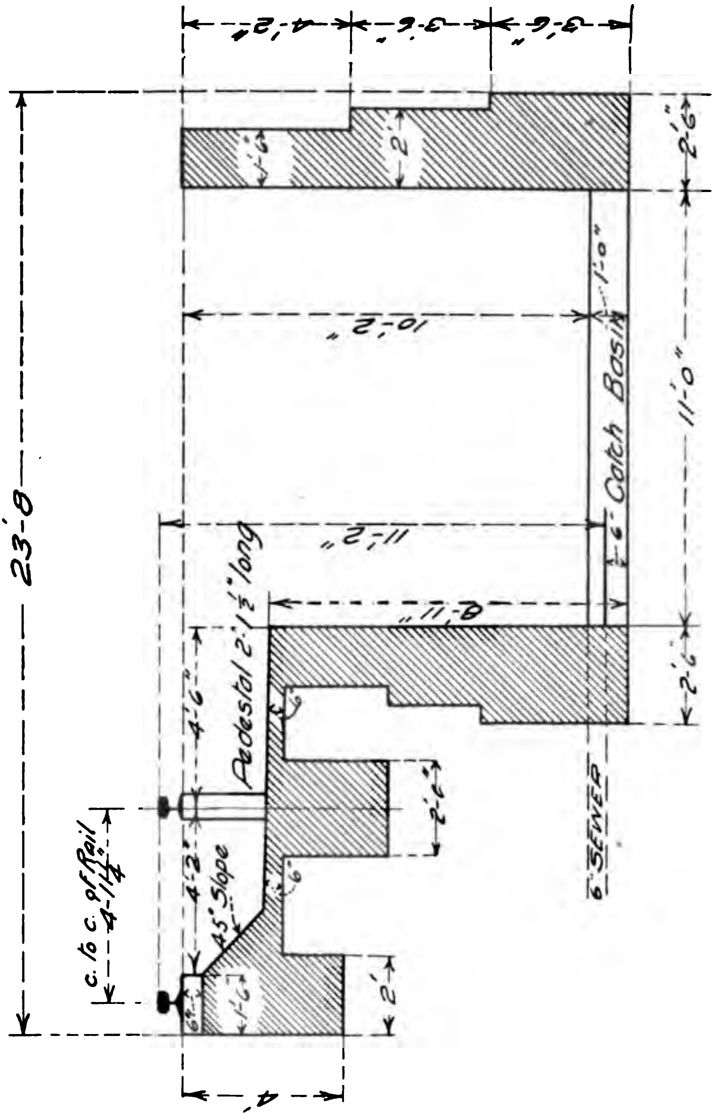


Fig. 11.—M. C. R. R. Cinder Pit Foundation.

4. Could not say, as men who clean engines find time to handle cinders also.

5. No power used.

6. Depressed track pit.

Mr. E. Brown, Master of Bridges and Buildings, Grand Trunk Railway, Allendale, Ont.:

Our general practice here is to use some form of coal storage pocket with incline to haul cars up and dump the coal direct into the bins, or else a Fairbanks-Morse elevator, according to the lay of the land. The cinder pits are of the common depressed type. The engines are cleaned into a kind of basket, which is subsequently lifted with a compressed air hoist, and dumped on to a flat car.

Mr. J. N. Penwell, Supervisor of Bridges & Buildings, Lake Erie & Western Railroad Company, Tipton, Ind.:

COALING STATIONS.

1. We have three kinds of coaling stations. Five of them are elevated trestles, with the old-fashioned bins with automatic drop aprons. The coal is shoveled by hand from the cars into the bins. The engine men operate the bins from the outside. We have one coaling station with elevated trestle and dump carts, coal being shoveled by hand from the cars into the dump carts, and then operated by the coal heavers. Three coaling stations with old-fashioned derrick and buckets, using air for power, the air being taken from a locomotive. None of our coaling stations are modern in any way and the one where we use the small dump carts is the most economical.

2, 3. Will hardly be considered with our old coal docks.

4. Costs from nine to twelve cents per ton, an average of about 10 cents.

5. My limited experience with modern coal docks will hardly permit me to give an intelligent reply.

6. I would recommend motor power if a current can be secured at reasonable price, otherwise steam engine. Gasoline engines are too uncertain and the unsettled price of gasoline forbids me recommending gasoline engines.

CINDER PITS.

We have no modern cinder pits. We have a depressed track for our cinder cars. We use iron piling with I-beams for stringers, and cast-iron clamps to hold the rail, in most of our cinder pits. Others are built of fire clay with cast-iron coping to hold the rail.

Where fifty engines or less per day are to be cleaned, I would recommend a cheap cinder pit with depressed track for cinder cars, transferring the cinders by hand, as the enormous expense for maintenance of modern cinder pits would not be justified.

Where from fifty to one hundred or more engines per day are to be cleaned a more modern pit would be required, but I can not give an intelligent opinion as to the particular kind, as we have none in use.

Mr. H. H. Eggleston, Supervisor, Bridges and Buildings, Chicago & Alton Railway Company, Bloomington, Ill.:

1. Link belt conveyor.

2. Cost of plant, two bins complete, capacity of each bin 130 tons, about $12,000.

3. Capacity of coaling stations from fifty to sixty-five tons per hour.

4. Cost of coaling engines per ton, from one cent to two cents, according to the number of tons of coal elevated.

5. Link-belt conveyor for coaling stations having a capacity of 500 tons or over. For coaling stations under 500 tons of coal, I would think the elevated trestle would be the cheapest. The link-belt plant does not take up as much room as an elevated coal trestle and in some places this would be more economical where the space is limited.

6. Prefer electric power in coaling stations, as there is less danger from fire than a steam or gas engine power plant.

CINDER PITS.

1. Depressed track for ash cars. We also have a link-belt conveyor from depressed pits. Traveling crane handles buckets on depressed track very cheaply and satisfactorily.

2. Approximate cost of construction of two pits and conveyors each 150 feet long, opposite each other, about $5,000.

3. Cinder pits, average number of engines in twenty-four hours, about fifty.

4. Cannot say exactly, as the men handling cinders do other work at coaling stations and I have no figures.

5. Same machinery used to operate link-belt cinder pits as is used to elevate coal. On depressed bins and conveyors, the same machinery is not used to elevate coal and cinders.

6. I think that depressed pits and conveyors would handle more cinders than a link-belt pit of the same capacity, as more engines can have their fires cleaned at the same time.

Mr. M. R. Strong, Engineer of Bridges and Buildings, Erie Railroad:

1. Coal is unloaded from drop bottom cars into a concrete pit; track over this pit being elevated four feet above the ground and carried on I-beams supported on concrete piers.

2. Plant consists of locomotive crane costing $6,000; concrete pit costing $1,300.

3. Forty tons per hour can be handled from one of these pits.

4. Cost of coaling engines per ton, between two and two-tenths cents; this price includes picking up cinders.

5. For terminal stations the best type of a coaling station is that described above. For points where trains take coal while in transit, elevated pockets from which the coal is conveyed to the hopper by link-belt or rubber-belt conveyors.

6. Electric power is preferable for operating machinery at coaling stations when same is available for continuous hard service; where electricity is not available, steam engine. Where coaling station is operated intermittently, gasoline engine.

COALING STATION AT BUFFALO, N. Y.

1. Coal is dumped from cars to storage pit and delivered on engines by locomotive crane.

2. One half cost of locomotive crane, $4,250; cost of coal pit, $6,000; total, $10,250.

3. Crane not worked to full capacity. Handles about twenty tons per hour, or an average of 400 tons each twenty-four hours.

4. Cost per ton, coaling engines, $0.046.

6. Gasoline or electricity, whichever is most economical.

COALING STATION AT PORT JERVIS, N. Y.

1. Robins' Conveying Belt Co. coal emptied into track hopper and elevated to coal pockets by belt inclined forty-five degrees.

2. Foundation and piping, $2,485.42; timber and steel structure, including hoppers, etc., $20,728.91; chutes, belts, electrical appliance motors, etc., $3,055.57; total, $26,269.90.

3. Tons per hour eighty. Each twenty-four hours, 1,400 tons.

4. Cost of coaling engines, $0.0225.

CINDER PITS.

1. Depressed pit in which cinders fall directly in the water and are removed and loaded into cars by locomotive crane.

2. Concrete pit, 90 feet long, $2,000 cost; I-beam girders, $360 cost; sewer draining pit about $300. The same crane handling coal handles cinders.

3. Three engines can be cleaned at once, making average time of cleaning fifteen minutes.

4. At a point where fifty engines per day are handled, cost of unloading cinders is included in the cost of two and one-half cents per ton for handling coal, as crane can handle in thirty minutes cinders from twenty-five engines.

5. Same style power should operate cinder plant that operates coaling plant.

6. A good type of pit for from fifty to seventy-five engines per day is shown on attached print.

CINDER PIT AT BUFFALO, N. Y.

1. Ashes are dumped into a pit 8 feet wide and 9 feet deep from locomotives. They are then loaded into cars by means of locomotive crane.

2. One half cost of locomotive crane, $4,250; cost of pit; $5,000; total, $9,250.

3. Greatest number of engines per hour, five; average twelve hours, forty; average twenty-four hours, eighty.

4. Cost of loading cinders, $0.018 per yard.

5. Yes. Locomotive crane handles both the coal and cinders.

6. Concrete cinder pit with double I-beam stringers under one rail line resting on cast-iron pedestals at twelve-foot centers. Cinders to be loaded by locomotive crane.

CINDER PIT AT SALAMANCA, N. Y.

1. Cinder pit is of concrete construction, about 300 feet in length, and operated by locomotive crane.

2. Approximate cost of construction, $10,500, including track supports and sewer.

3. Engines cleaned per hour, five. For an average of twelve and twenty-four hours, twenty-five and forty-six, respectively.

4. Cost to handle cinders per yard, $0.03.

5. Locomotive crane.

CINDER PIT AT SUSQUEHANNA, PA.

1. Concrete cinder pit, 8 feet, 6 inches wide, 11 feet deep and 320 feet long.

2. Cost of pit, including locomotive crane, $18,000.

3. It is possible to clean twelve engines per hour. Greatest number engines cleaned in twelve hours forty-one, greatest number cleaned in twenty-four hours eighty.

4. The total cost of hauling cinders from pit to cars is $0.007.

5. Locomotive crane handles cinders only at this point.

By M. Bishop, Master Carpenter, C., R. I. & P. Railway, Chickasha, I. T.:

1. On the Oklahoma Division of the Chicago, Rock Island & Pacific Railway, we have the William's, White, pocket coal chute, elevated trestle. Shovel by hand from cars to pocket.

2. The cost of a fifteen-pocket coal chute runs from $3,500 to $3,800.

3. This style and size of chute will afford from eight to ten tons per hour.

4. Cost of coaling engines by contract is nine and one-half cents per ton. This includes the cleaning up around coal chute and loading cinders.

5. In my opinion, the best type of a coaling plant for all capacities, more especially a one-hundred ton or greater, should be a large bin, elevated trestle, with a spout or an apron outlet, with a positive gate so that the coal can be trimmed on the tender to the amount required, dispensing with any waste or droppings of coal on the ground. The height of these storage pockets should be so that hopper bottom cars could be used. And an incline built, where possible, so that the coal cars could be placed by locomotives instead of hoisting machinery. My reason for using locomotives is this: When hoisting machinery is installed and there is a break down, it becomes necessary to resort to coaling engines by hand. With tne locomotive you are always prepared for what is known as "putting up coal." In connection with this, the car must be located with locomotives for the hoisting machinery, and with very little more effort, the coal could be put up on the chute. I will say that I have been reliably informed that on one of the other divisons where they had the hoisting coaling plant at one of the intermediate coaling stations, there was a passenger train delayed four hours on account of plant being broken down.

6. I prefer the locomotive for handling coal. I wish to state in connection with the coaling subject that we are about to install three modern coaling plants on this division, and that we have adopted the William's, White, pocket arrangement storage bin, in connection with the undercut gates and hoisting machinery. This type of chute I do not favor for two reasons: First. The great waste of coal that is caused by dropping more than the engine will hold. Second. In case of a break down with the hoisting machinery, it becomes necessary to resort to coaling engines by hand, which, especially in intermediate stations, is a great delay. But I have understood that they are going to abandon this style of chute, and install a different kind, of which I have not seen plans or description.

CINDER PITS.

1. We have the depressed track for ash cars, and cinders are handled by hand.

2. I have no figures at hand to give cost of construction. The cost would probably run from ten to fifteen dollars per lineal foot. The type is concrete wall and base, cast column and rail girder.

3. The greatest number of engines we handle is about thirty-five in twenty-four hours.

4. The cost of handling cinders is taken care of by the coaling contractors. As I stated, they have the contract at nine and one-half cents per ton for handling coal, and they take care of the cinder pit and waste coal droppings from the chute.

5. We have no machinery.

6. I have not had any experience with machinery for handling cinders. In my opinion that is something on the order of small dump cars of steel construction, and the cinder pit being so con-

structed as to accommodate them. And they are handled on an inclined track running over the cinder car and dumped.

Something on this order, I believe, would be profitable where they handle fifty or more engines.

By Mr. W. B. McKenzie, Chief Engineer, Intercolonial Railway, Moncton, N. B.:

According to information given me by the mechanical department, I find that the cost of handling coal and ashes at the following places is as below:

Moncton, by the Hunt Elevator System, handling coal, per ton, thirteen and two-thirds cents, thirty tons per hour; capacity of bin, 500 tons. Cost of handling ashes per cubic yard, five and two-thirds cents, if this plant had work to run to its full capacity.

Stellarton, dumping from trestle onto an elevated floor and running into engines by small dump cars. Cost, twenty-one cents per ton for coal, and ten cents per cubic yard for removing ashes by hand. Capacity of plant, 100 tons every twenty-four hours.

Point Tupper, shovelling coal from cars into small trolley cars and dumping into engines, twenty-one cents per ton. Removing ashes by shovelling from ash-pit onto flat cars, eleven cents per cubic yard.

By Mr. D. McLennan, Mechanical Foreman, Intercolonial Railway, Sydney, N. S.:

In reply to yours under date of the first inst., I think the best we could do with the coaling shed we have here would be 100 tons each twenty-four hours, or about four and one-half tons per hour, with three men by day and the same number by night. When working to this capacity, it would cost about eleven and three-fourths cents per ton to coal the engines. We handle the cinders here by hand, first shovelling them from the ash-pit onto a platform, and then from the platfrom onto flat cars, and to handle in this way cinders produced by 100 tons of coal consumed, would cost about twelve cents per cubic yard.

By Moses Burpee, Chief Engineer, Bangor and Aroostook Railroad, Houlton, Me.:

HANDLING COAL.

1. Shoveled from cars standing on trestle in shed, then delivered to locomotives in tubs raised by cranes, usually operated by hand, but in a few cases by power. In some cases also dumped into pockets or chutes through which it is delivered to locomotives. In other cases, shoveled from cars into sheds having an overhead I-beam with trolley, to which tubs, loaded by hand, are raised by differential pulley, or, as in our case, by air hoist. These are switched onto a cross track running out over the tender, dumped and returned to main trolley rail and lowered to coal pile.

2. Sheds cost about $1 per ton capacity. Fixtures and machinery, about $1,000 per shed.

3. Capacity is limited to the amount of labor, in our experience.

4. No figures.

5. Depends on circumstances. Think elevator and chute style best where possible to use it. We have heretofore been obliged to stock up for six months every spring and fall, in which case large sheds or stocks are necessary, and a good deal of hand shovelling requisite.

6. Compressed air where possible. Electric or gasoline.

CINDER PITS.

Cannot give from experience any opinion as to improved pits. We have not used power to handle ashes.

By C. F. Loweth, Engineer and Superintendent, Bridges and Buildings, Chicagó, Milwaukee & St. Paul Railway Company, Chicago:

It is only comparatively recently that this company has introduced the use of mechanical coaling plants and cinder pits on its lines, and to date, have had experience with only two types of such coaling stations, namely, the car haul system and the link-belt and bucket elevator system, typical plans of which I am sending you under separate cover.

The former consists of one or more elevated storage pockets of any desired capacity, set on beam scales for the purpose of weighing the coal out to the locomotives, with an incline track on which the loaded cars are hauled up over the storage pocket and dumped on breaker bars on which the coal is broken to the proper size before it falls into the storage pocket.

The cars are hauled up preparatory to unloading by means of hoisting machinery of the friction drum and gear type, driven either by steam, gasoline or electric power, and unloaded. The car is then let down the incline by means of the same hoisting machinery and the process is repeated.

The handling of coal through a coaling plant of this type is fairly economical, when only hopper bottom cars are used and the coal is in comparatively small lumps. Coal in large blocks or lumps requires much breaking with hammers, over the breaker bars. This process is slow and the cost of handling proportionately higher.

The cost of handling coal through a plant of this type may vary from three and one-half to eight cents a ton, owing to varying conditions. The cost of this type of plant may vary according to size and capacity, from $8,000 for the smallest, with a storage capacity of 100 tons, to $20,000 with a storage capacity of say 5,000 tons, and the handling capacity may vary from twenty to fifty tons per hour, according to conditions.

As to the link-belt and bucket elevator type of station: They consist of one or more track hoppers into which coal is dumped and from which it is conveyed to a crusher by means of a horizontal conveyor or carrier, thence to the elevator which conveys it into storage pockets, the pockets being set on scales for the purpose of weighing out coal to the engines.

This type of coaling plant has one distinctive advantage over the other above described in point of economy in the handling of coal, in that the coal is crushed mechanically, also in the more rapid process in getting the cars placed for unloading; but the cost of maintenance is considerably in excess of the other type, in that it contains much more machinery subject to wear and tear.

The capacity of these plants may vary from twenty-five tons per hour, with a storage capacity of seventy-five to 100 tons for the smallest, to 100 tons per hour with a storage capacity of 500 tons or more for the largest, and may cost from $9,000 to $30,000.

The cost of handling coal through this type of station under favorable conditions, that is, with exclusively hopper bottom cars and coal in condition to run freely, should not exceed two and one-half to four cents a ton. Under less favorable conditions, it may cost as high as eight cents.

I will add that I am not prepared to express an opinion as to the best type of coaling station in use. Electrical power is undoubtedly the best for driving coaling plant machinery, although steam or gasoline power may be successfully and economically applied.

As to cinder pits: This company uses the open shoveling pit with adjoining depressed track, the cinders being shoveled by hand, also the mechanical pit, consisting of a number of pans or cars, in which the cinders are raked out of the locomotive ash pans and elevated on an incline track and dumped in cars on an adjoining track by means of a pneumatic hoist.

The cost of construction of the above described pits is about the same, and the cost of handling cinders through them does not vary materially.

By Robert McKibbon, Master Carpenter, Pennsylvania Railroad, Pittsburg, Pa.:

HANDLING COAL.

The cars are run on an incline to an elevated trestle and dumped into bins. The total capacity of these bins is 650 tons, which at present, are giving us very excellent service. You will note by our plan herewith that these bins are equipped with the link-belt chutes and the coal is taken approximately and handled by the fireman of the engine which is being coaled.

While the first cost of this coaling station seems high, we more than overcome the cost, in handling the coal economically, you can readily see by our figures giving the cost of handling coal per ton, which I believe you will agree with me is very low compared with other stations with which you are doubtless familiar.

This coaling station has been in service now for over two years and has not cost us a single dollar for repairs, other than accidents which are caused by engineers moving their engines and pulling the chutes off, which sometimes happens in cases where negligence occurs.

You will also note that the coal is given to engines by gravity, which does away with a great deal of extra labor on the part of machinery, and in my opinion, I believe that this is one of the most complete coaling stations on the Pennsylvania Railroad system.

Enclosed you will also find a summary of the cost of coaling station, capacity in tons per hour, and for each twenty-four hours, and cost of coaling engines per ton.

I would also call your attention to the sanding arrangement that we have built on the end of this coal tipple for the purpose of sanding our engines. The sand is furnished engines by compressed air at the same time that the engines are being coaled.

In regard to the cinder pits, I send you herewith blueprint of our cinder pit and ash hoist now in operation on the Monongahela Division of the Pennsylvania Railroad at Thompson Yard. These are the only ash pits and ash hoists on our division worth mentioning.

We have ash pits and ash hoist at two or three different points on the division, where the same kind are in use as shown on the enclosed prints, which in my opinion are a great labor saver, and very complete in handling ashes which are taken from engines.

We do not handle the cinders at our cinder pits by the yard, as the engines are cleaned by piece work. The cinders are dumped into a cinder bucket and put in a car, and then turned over to the supervisor for use of filling purposes on the division. You will note by the blueprint that these cinders are handled by compressed air and I wish to state that we get very good satisfaction from our style of cinder pits and hoists.

Cost of Thompson coal wharf, located at Thompson Yard, on Monongahela Division of Pennsylvania Railroad:

Material.		
Sand, gravel and cement,	$2,976.52	
Iron sheeting for use of lining coal bins,	861.00	
Rails, bolts, nuts, washers and fixtures,	2,291.34	
Lumber,	10,587.90	
Eight coal chutes and installing same,	2,210.00	
Sand elevators and installing same,	219.50	
		$19,146.26
Labor.		
Masons on foundation,	$2,710.00	
Carpenters, erecting,	2,723.41	
Tinners and plumbers,	184.53	
		$5,617.94
Total,		$24,764.20

Cost of Thompson ash pit and hoist on the Monongahela Division of the Pennsylvania Railroad:

Material.		
Brick, sand, gravel and cement,	$2,254.12	
Rails, spikes, etc.,	180.00	
Pneumatic ash hoist and three buckets,	947.72	
		$3,381.84
Labor.		
Masons' and carpenters' labor,		1,433.29
Total,		$4,815.13

Cost of handling coal at Thompson coaling station:

1906	January,	$0.018
	February,	.02
	March,	.019
	April,	.02

Number of tons of coal handled at Thompson coaling station:

1906	January,	4,786
	February,	5,304
	March,	5,933
	April,	5,617

Greatest number of engines cleaned per hour, and average in each twelve and twenty-four hours at Thompson cinder pits:

		Per hour.	Av.12 hrs.	Av. 24 hrs.
1906	January,	2	2	50
	February,	4	4	99
	March,	2	2	50
	April,	2	2	47

Cost of coal for operating ash hoist at Thompson cinder pit:

1906	January,	$83.22
	February,	75.74
	March,	76.39
	April,	65.78

By Arthur Montzheimer, Chief Engineer, E., J. & E. Ry., Joliet, Ill.:

COALING STATIONS.

1. Our coal is handled from an elevated coal chute. The coal is dumped in the chute by gravity in bins holding 100 tons. From these bins the coal is allowed to pass by gravity into the smaller pockets same as the Williams & White coal chute. Cars of coal are pulled up the chute by means of gasoline engine and cable.

2. The approximate cost of this plant is $9,000.

3. It has a capacity of eleven tons per hour or 264 tons per twenty-four hours.

4. Cost of coaling engines is from one to two cents per ton

5. This is the best type of coaling station I have had any experience with. I think it will handle business at almost any terminal point.

6. We prefer gasoline engine to hoist coal with, although at one place we are hoisting coal with a steam engine.

CINDER PITS.

1. We use depressed track for cinder cars, the cinders being loaded by hand. The illustration herewith shows the style of casting or cinder pit ties used for supporting the track carrying the engines across the pit.

2. I cannot give you any figures on the cost of this type of

Style No. 1. Weight 1,600 lbs.

Style No. 2. Weight 1,100 lbs.

FIG. 12.—Cinder Pit Ties. Made of Cast Iron. Can be made for any Section of Rail. (By courtesy of The Buda Foundry & Mfg Co., Chicago, Ill.)

construction, as it varies according to the location, depth track is depressed, etc.

3. A pit of this kind, 100 feet long, can handle eight or ten engines per hour.

4. Cost of handling cinders amounts to eleven cents per cubic yard.

5. No machinery is used in connection with this cinder pit.

6. I think this is a very good type of cinder pit for the ordinary terminal, but for a large terminal I would recomend a pit where the cinders are hoisted by power and dumped in a bin from which they can be dumped by gravity into the cinder car.

By J. B. Brown, Kansas City, Clinton & Springfield Railway, Clinton, Mo.:

COALING STATIONS.

1. We have on our system five or six different styles of coal chutes, but I will take our standard at Springfield for answers.
Coal is handled by link-belt conveyors and elevated trestles.

2. Approximate cost, $20,000.

3. Do not know the capacity in tons per hour.

4. Cost of coaling engines, two to five cents per ton.

5. My opinion is the link-belt conveyor is the best type of coaling plant, because it requires less room for capacity in tons than any other.

6. Prefer steam engine for power, as they can always be depended upon to do the work.

CINDER PITS.

1. Our cinder pits are depressed track for ash cars and link-belt conveyors.

2. These pits are in connection with our coal chutes; combined cost, $20,000.

3. Do not know number of engines coaled per hour.

4. Cost of handling cinders, from four to eight cents per yard.

5. The machinery is operated by same power as coaling plant.

6. Link-belt conveyor and depressed track for ash cars.

HANDLING COAL.

1. Coal has been handled from elevated trestle, dumping coal from cars into pockets, and also at some of the stations by shoveling coal from cars into the pockets and at others by link-belt conveyor, and temporarily we have used crane for coaling from cars or storage pile.

2. You will find approximate cost of plant on drawings attached.

3. Capacity in tons per hour also to be shown practically on the blueprints.

4. I am unable to reply to this question. I have requested this information from the division superintendent, but, up to date, have had no reply. The cost for carrying for elevated trestle where coal is dumped into pockets from cars, was, for twenty-five and thirty engines per day, not over $30 per month.

5. The best type of coaling stations where there is plenty of room for inclines, is the elevated trestle, where coal is dumped from the cars into the pockets. Whenever one is cramped for room, a link-belt conveyor is practical, on account of the ease of handling coal directly from the cars to the bins.

6. In operating machinery for coaling stations, I prefer either steam engine or electric motor.

CINDER PITS.

1. Am attaching blueprint showing depressed track for ash cars. Have never used link-belt conveyor or swinging or traveling crane handling buckets in caring for ashes from the ash pit.

2. Approximate cost of construction is shown in detail on blueprints.

3. With the cinder pits as shown on blueprint, we clean taree or four engines per hour, or at an average of seventy-two in twenty-four hours.

4. Regarding cost of handling cinders per yard, I have not been able to get this information from the division superintendent up to date.

5. No machinery has been used on my division for operating cinder pit.

6. The best type of pit is cast-iron pit, as shown on drawing No. D–837.

I am attaching herewith estimate of the cost of installing one of these pits.

These prints have been obtained through the courtesy of my superior officer, and I trust they will assist you in formulating your report on this subject, provided they are not too late in reaching you.

In one of our files, cost of installation of cinder pit, drawing No. D–837, at Albuquerque, was $931.33, itemized as follows:

Labor.		
Quarrying rock and excavation,	$147.25	
56 cubic yards concrete masonry,	168.00	
21 cubic yards rubble masonry,	52.50	
		$367.75
Material.		
Lime and cement,	$166.00	
Metal,	397.58	
		$563.58
Total,		$931.33

A large number of blueprints from different roads were on exhibition at the convention.

DISCUSSION.

Mr. Reid.—In reference to modern coaling stations, we have built several recently on the Lake Shore Road, using very largely the link-belt method of hauling the coal. I do not know whether these are the best or most successful in operation, but they have given very good service with us so far. We have some that coal three, four and six tracks. They have concrete foundations and bins for holding the coal. I suppose most of the members are familiar with the general arrangement of them. There is a steel or wooden structure which is carried on four steel posts, with main girders over the tracks. The four-track chutes have girders about sixty feet long, and all have cross girders between the bins. All the coal is carried up to the bins, which can be weighed, so that we know the weight of the coal delivered to each engine. The four-track chutes are over the main tracks between stations, the six-track chute is at the terminal station at Elkhart. We also have a three-track chute at Toledo, built, by the way, almost entirely of second-hand bridge material. We had a large amount of second-hand bridge iron at our storage yard and we wanted this Toledo chute in a hurry and could not get quick delivery on new steel, so utilized second-hand girders and other material. There was no particular economy in doing so, but in this case we did it on account of being unable to obtain quick delivery of new steel.

Mr. Killam.—I would like to ask what it costs, per ton, to transfer the coal from the supply bin to the locomotive?

Mr. Reid.—I do not know. The handling of the coal is in another department and I haven't any idea what the expense is, but I think it is very little. The coal is dumped from the cars into a hopper and is carried up to the bins. A gasoline engine is used and one man does the work. I do not know what it costs.

Mr. Killam.—I asked for information as to the cost of handling coal at the various stations on our line, and in do-

ing so I made application and went into the office and nearly obtained the figures, as I thought, but one of the clerks in the mechanical superintendent's office said that our coal costs so much to handle that we do not wish to give out the information. I was determined to have it, and told him that there was a question coming up before our convention by way of comparison, as to the cost of handling the coal, and if anyone else could handle the coal cheaper than we could we would like to find out how it was done. We have one of those elevated coaling stations made in the States, but it costs more to handle the coal than it should because this plant is not worked up to its full capacity. I believe it costs fifteen and a quarter cents per ton, and at other stations out along the line, where conveyed by hand, it costs us some sixteen or seventeen cents per ton.

Mr. Reid.—I think it costs us about two cents per ton for handling.

Mr. Powers.—I think Mr. Montzheimer could furnish some information in regard to this coaling situation if you will call upon him.

President.—I would ask Mr. Montzheimer to make a few remarks in regard to handling coal. I know he is familiar with the work and can probably give us some very useful information in regard to this matter, and we will be glad to hear from him.

Mr. Montzeimer.—I cannot state the exact figures, Mr. President, but the coal chutes we are using are a combination of the Williams & White pockets and the large hopper above, or storage bin. The cars are pulled up a twenty per cent. incline by gasoline engines connected with a hoist, which is geared up to furnish the necessary power. The pockets, I think, have a capacity of 150 tons. The engineer in taking coal pulls down the apron and takes as much as he requires, and I think we have handled the coal for one and a half cents a ton. I think it would average about two cents; perhaps not; but the cost of labor for handling this coal is very slight.

President.—I would like to ask Mr. Montzheimer if there are any plans of this coaling station of which he speaks, in this collection.

Mr. Montzheimer.—I do not think that there are any, but I can send a set of these plans if you wish for them. The entire cost of these chutes is about $9,000. They are a large set of plans and would occupy a good deal of space in our proceedings.

Mr. Staten.—I have just completed one of the Hunt coal hoist bins and it is a somewhat expensive arrangement. We are using the steam from our regular machine shop, and we handle the coal and cinders, etc., all from the same plant. But we have very heavy machinery and I think it cost $11,227. The whole building cost $26,032. However, it is arranged for coaling four tracks.

Mr. Cummin.—It is a difficult question with us to determine how much it costs to handle coal in these coal pockets, for the reason that we do not have anything to do with handling the coal. We have a 3,000-ton coal pocket at Long Island City, the link-belt system, and I venture to say that the man who has charge of running that plant would estimate the cost of handling the coal at about three cents a ton. But it seems to me, in figuring the cost of handling that coal we should include in our calculation the interest on the cost of the plant, and we should also take into consideration the maintenance of that plant, which amounts to a great deal each year, with the link-belt system, or any other, and three cents a ton cannot cover the cost of handling the coal. Take, for instance, a $30,000 plant and compute the interest on that investment, and then allow a proper amount for repairs. I think that should all be taken into consideration. We should not positively state in our proceedings that we can handle coal for two or three cents a ton.

Mr. Killam.—In our accounts of expenditure in handling the coal, every item is considered; the repairs are charged to the handling of the coal, and while we handle it cheaper

than sixteen or eighteen cents, which it may cost when shoveled into pockets by the men, that does not include the expense of interest on the structure, but when this is included you will obtain the exact amount of the expense of handling the coal, and it certainly should not be stated that coal can be handled for two cents a ton.

President.—There is evidently a great variation in the expense of coaling. I think I remember hearing someone say the cost of handling was as low as one and one-half cents a ton, and others as high as eighteen cents a ton, so it does not seem possible that you are all figuring on the same basis.

Mr. Cummin.—The man on the chute does not know anything about the cost of handling the coal. He simply knows what it costs him. But the fact is, it costs a great deal more.

President.—The point is well taken. The cost of handling the coal should include the entire cost; depreciation of the plant, interest charges, etc., unless so stated in the report, or if it is for labor alone, it should be so stated.

Mr. Reid.—In our proceedings, as suggested by Mr. Cummin, it should be the basing cost. If a plant costs $40,000, and will handle 100 tons of coal in a certain length of time, the interest on that investment should be charged against the cost of handling the coal, and the maintenance and repairs should be added to this. I think that is the only proper way to ascertain the exact cost. By taking into account the tonnage handled, the original cost of the plant and the expense of the wages and repairs at the chute, the actual cost of handling the coal can be obtained.

Mr. A. S. Markley.—Should not all these items of expense be kept separately?

Mr. Reid.—Yes, sir; I think they should be.

Mr. Alexander.—The trouble is, we do not do this. We erect the plants and make repairs, and someone else handles the coal. But there is another point in considering this coal business. We must have small plants as well as

large ones. Along our line of road, at some of the places, we have to coal largely by hand, and we are paying, where little coal is used in those places, about fifteen cents a ton. We use a common derrick, and try to arrange so that the one man who does this can also do some other work.

Mr. Perry.—We have chutes that hold from six to seven hundred tons. We run out on an elevation of about five feet to the hundred. We run the cars right out and dump the coal into the pockets, and from these the fireman takes it, and this costs three and one-half cents a ton. That does not, however, include the interest on the plant, of course.

Mr. A. S. Markley.—Is that handled by hand or by dump cars?

Mr. Perry.—With dump cars which empty the coal directly into the pockets. We have eight or ten chutes on each side of the track.

President.—Is there anything further to be said? If not, we will close this subject, as Mr. Lichty has some communications which he would like to present.

VII.

CONSTRUCTION OF BUMPING POSTS FOR PASSENGER AND FREIGHT CARS.

REPORT OF COMMITTEE.

To the President and Members of the Association of Superintendents of Bridges and Buildings:

When I received the appointment as chairman of the committee to inquire into subject number seven, as to the best buffer bumping block for railway passenger and freight cars, I accepted the position knowing that it would not be possible for me to have any personal consultation with any member of my associate committee during the time of gleaning the necessary information to form a report, that a consultation would only be had immediately before the Convention assembled, so proceeded to seek information by sending out circulars to members of the Association.

I sent out 140 circulars to members of the Association throughout the United States, Canada and Australia and have received some thirty-nine replies.

Twenty-seven wrote in favor of the Ellis bumping post, passenger and freight cars; five in favor of either the Ellis or Gibraltar bumping posts; two consider the Gibraltar bumping post the better one; two consider a pile bumping post the best where it can be put in; two misunderstood the circular, as the word "post" was omitted after the word "buffer" by mistake in the circular; one did not know anything about the subject.

Many of the replies favor, beside the Ellis and Gibraltar patterns, bumping posts such as a pile of earth and elevated ends of rails; some, posts set deep in the earth well braced; some, pile bents as before mentioned; also the Economy train bumper, and others of much merit. Illustrations of the Ellis and Gibraltar bumping posts are given herewith, as well as those sent in by our members.

There appears to be no doubt that the Ellis and Gibraltar, with one or two styles akin to those are the most acceptable bumping posts for such places as terminal stations; ends of sidings, ending against a street or building; on a trestle or wharf, or where a cheaper device cannot be satisfactorily used.

There are some thirty-six Ellis bumping posts on the Intercolonial Railway, in such places as St. John, N. B., Halifax, N. S., Stellarton, N. S., on the ferry steamer *Scotia*, at Mulgrave, and at Sydney, C. B., and find them all that can be desired.

The Intercolonial Railway has also other devices, such as pile of earth, rails with up-turned ends, sleepers laid beyond the end of the track and rails laid on them, so that if a car should run over the end of the track it can be hauled on again; of course this can only be used in certain places. In some places they use a large post set in the ground, well braced with heavy timber, but do not find anything so secure as the Ellis bumping posts, well-cushioned with rubber, back of the head block.

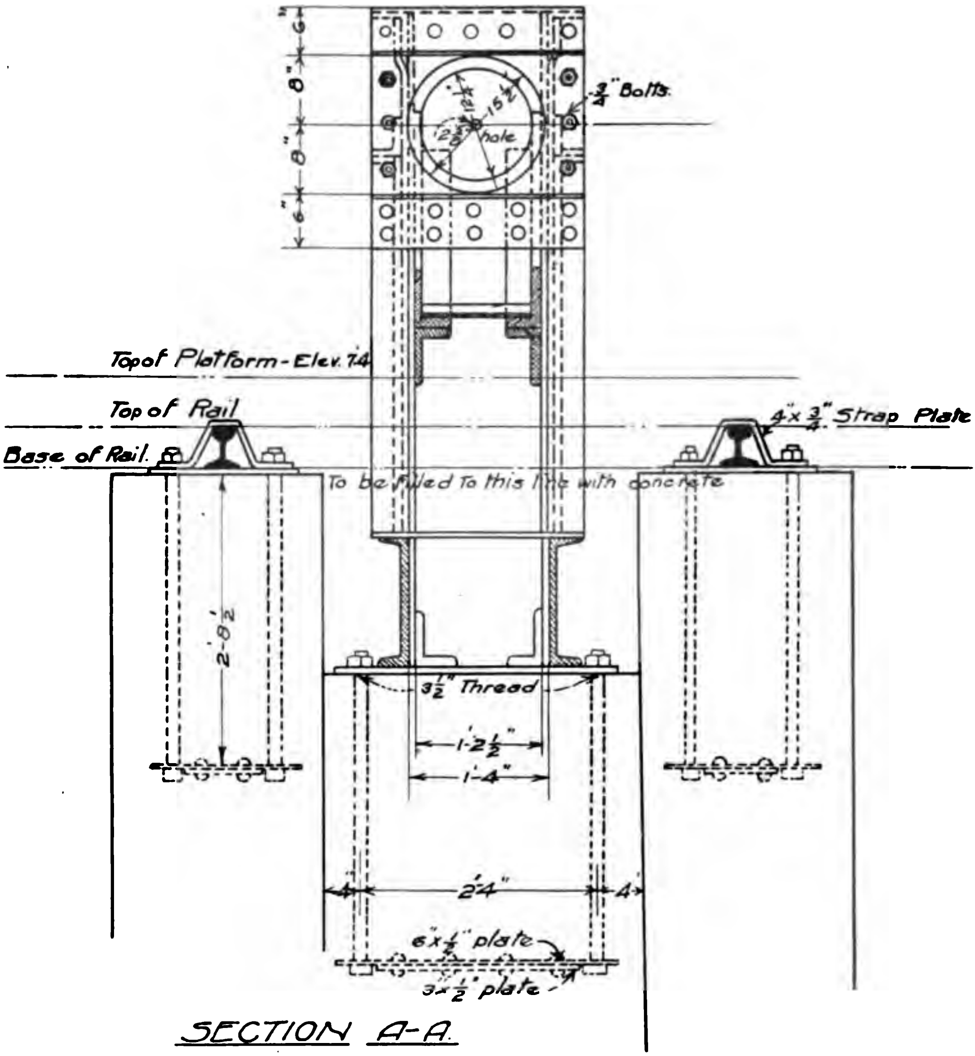


FIG. 13.—D., L. & W. R. R. Bumping Post for Hoboken Train Shed.

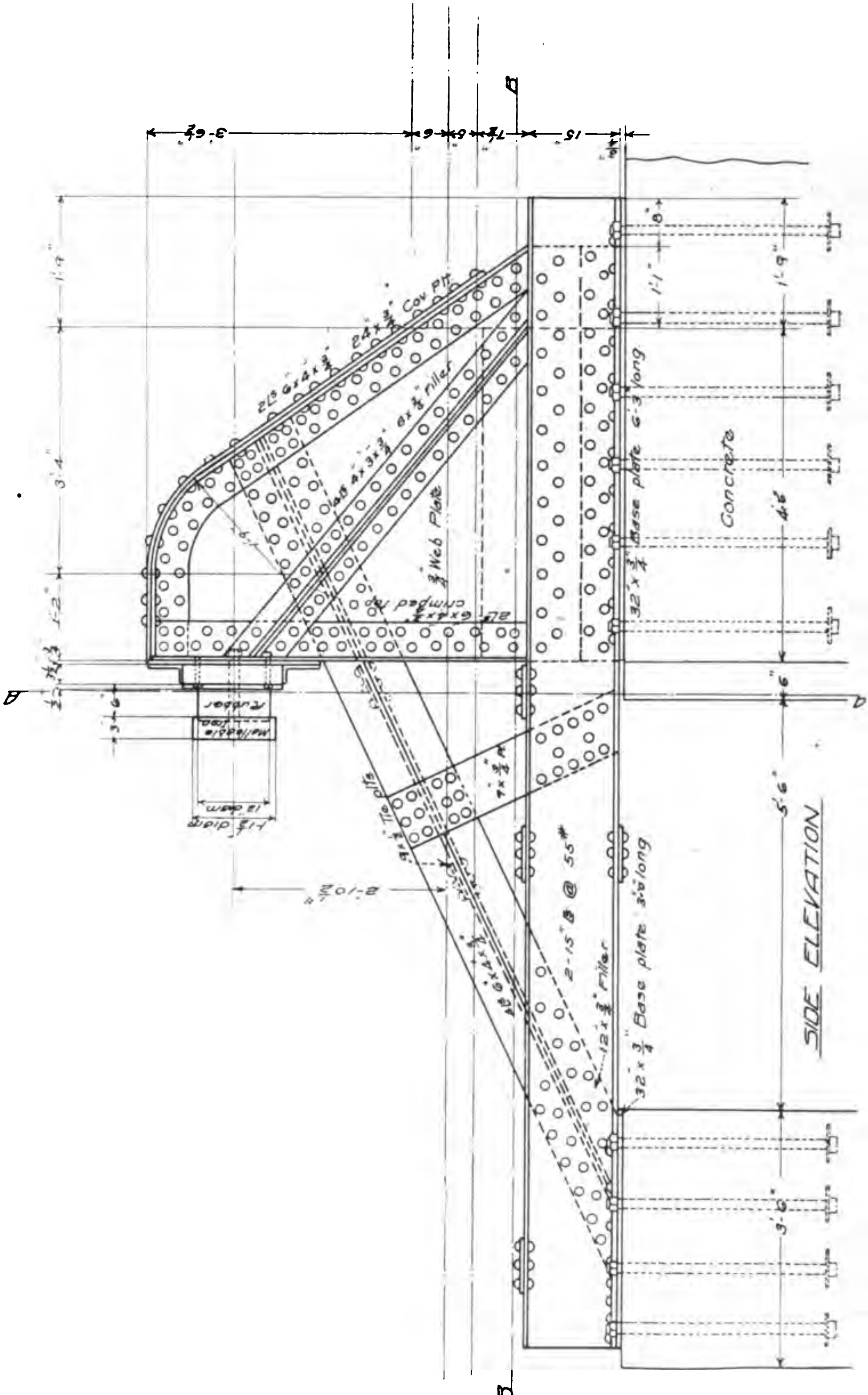


Fig. 14.—D., L. & W. R. R. Bumping Post for Hoboken Train Shed.

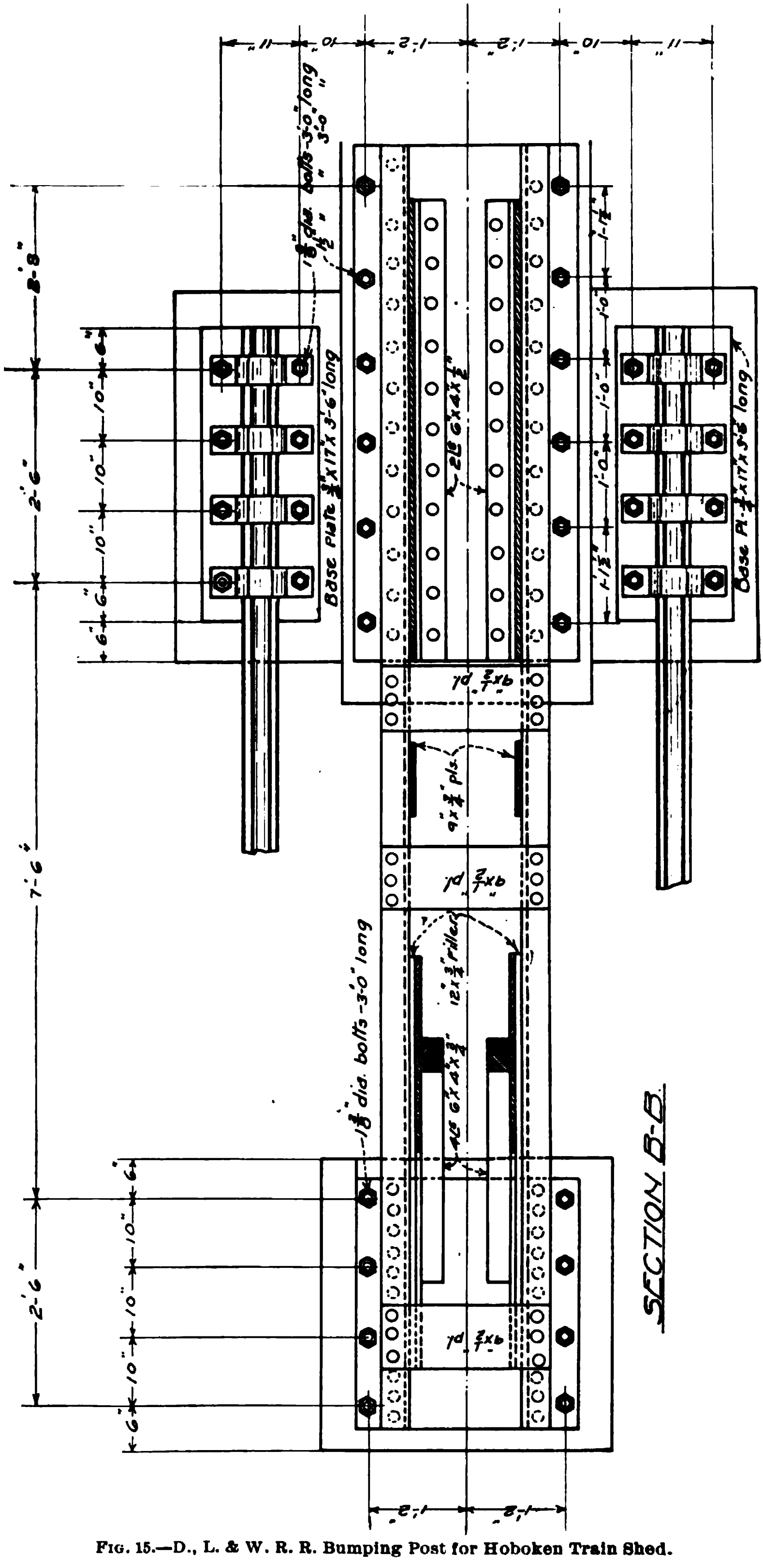


Fig. 15.—D., L. & W. R. R. Bumping Post for Hoboken Train Shed.

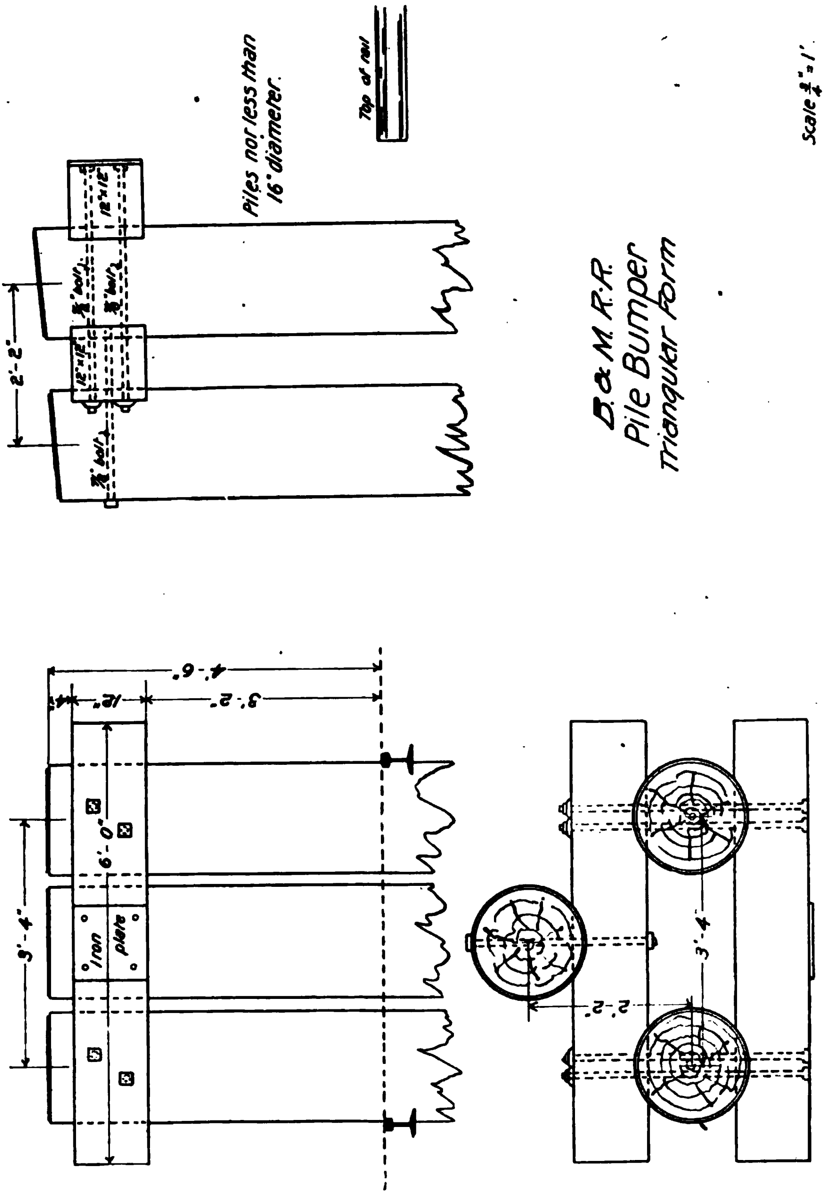


FIG. 16.—Pile Bumper, B. & M. R. R.

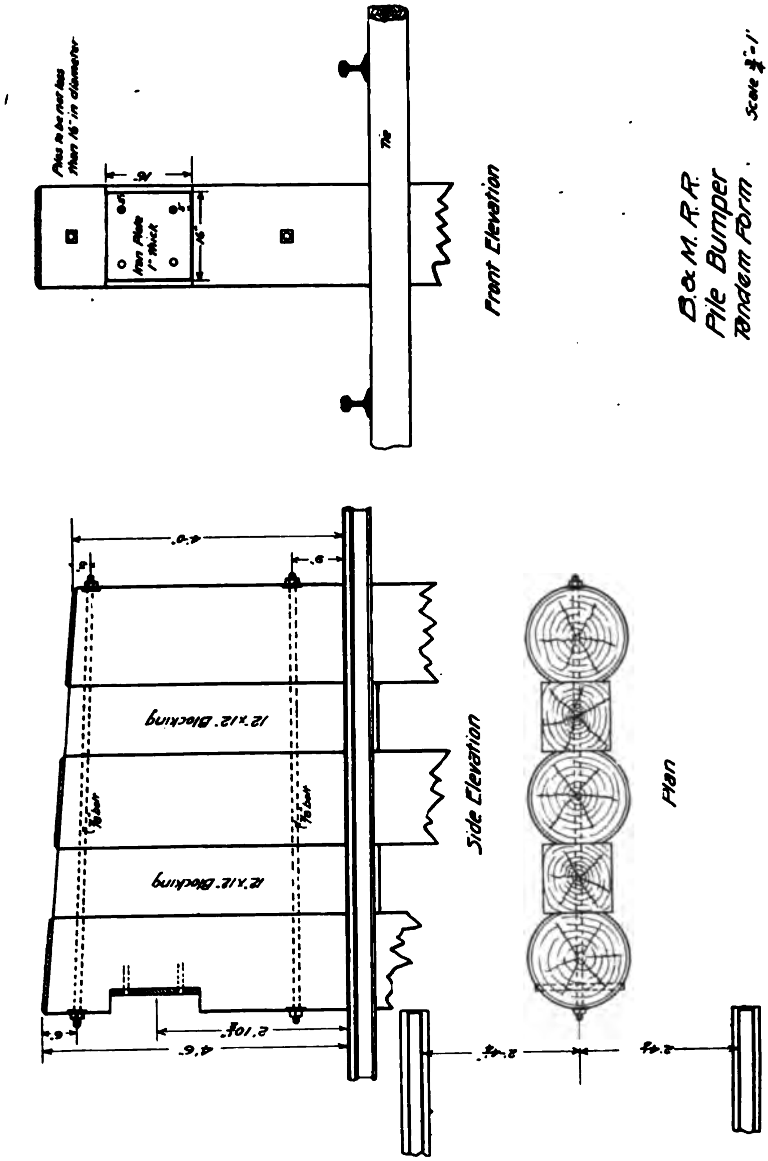


FIG. 17.—Pile Bumper, B. & M. R. R.

The Intercolonial Railway use the costly post where absolutely necessary and the cheaper device where it will answer. The red flag with the staff stuck down at the stopping point, with the men's situation depending on the passing of the same has a wholesome effect on the men and saves breakage, etc.

Below please find the different reports of the members and plans severally referred to, which are interesting and instructive, and which I consider worthy of having a place in the printed Proceedings.

A. E. KILLAM,
Chairman of Committee.

APPENDIX TO REPORT ON BUMPING POSTS.

William A. Lydston, Supervisor Bridges and Buildings, Eastern Division, Boston & Maine R. R.:

We use pile, framed southern pine, Ellis, Gibraltar, and also a sand bumper. We have the best success with the pile bumper shown on plan, marked "Triangular form." Piles used are native white oak, 24 feet long, 18 to 24 inches diameter at butt, and 12 inches at the point. This makes the best bumper for hard usage that we have on this division of our road. Cost of these bumpers is about $80 per set.

We also use a sand bumper. This is a box made of good old timber halved together, making a box, say 8 feet by 12 or 15 feet, outside, filled with sand, soil or clay, in fact any kind of heavy material. This makes a very good bumper, and if one is built of the proper height it can be used to replace lumber that has been displaced on cars by rough handling. These bumpers require so much room that they are not used to any great extent.

A. A. Page, Supervisor Bridges and Buildings, Southern Division, Boston & Maine R. R.:

I think piles arranged as shown on plan, marked "Tandem form," makes a stronger bumping post than when driven, as on plan marked "Triangular form." The cost is practically the same and the piles can be driven in this way in places where it is impossible to turn off the driver enough to drive them in a triangle.

A. B. Hubbard, Supervisor, Terminal Division, Boston & Maine R. R.:

The efficiency of bumping posts during late years has been increased rapidly to meet the severe conditions obtaining in service, and my railroad experience of 29 years leads me to consider the subject of the first importance as a protection from serious consequences and as worthy of careful study and consideration.

The location governs the use of bumpers entirely, occasionally requiring them to be placed four feet deep; in other cases two feet; and, again, satisfactory results are obtained by placing them on top of a wharf.

The Gibraltar bumping post, of very light construction, several of which were installed about nine months ago in one of our yards, have given no trouble up to the present time; for the rea-

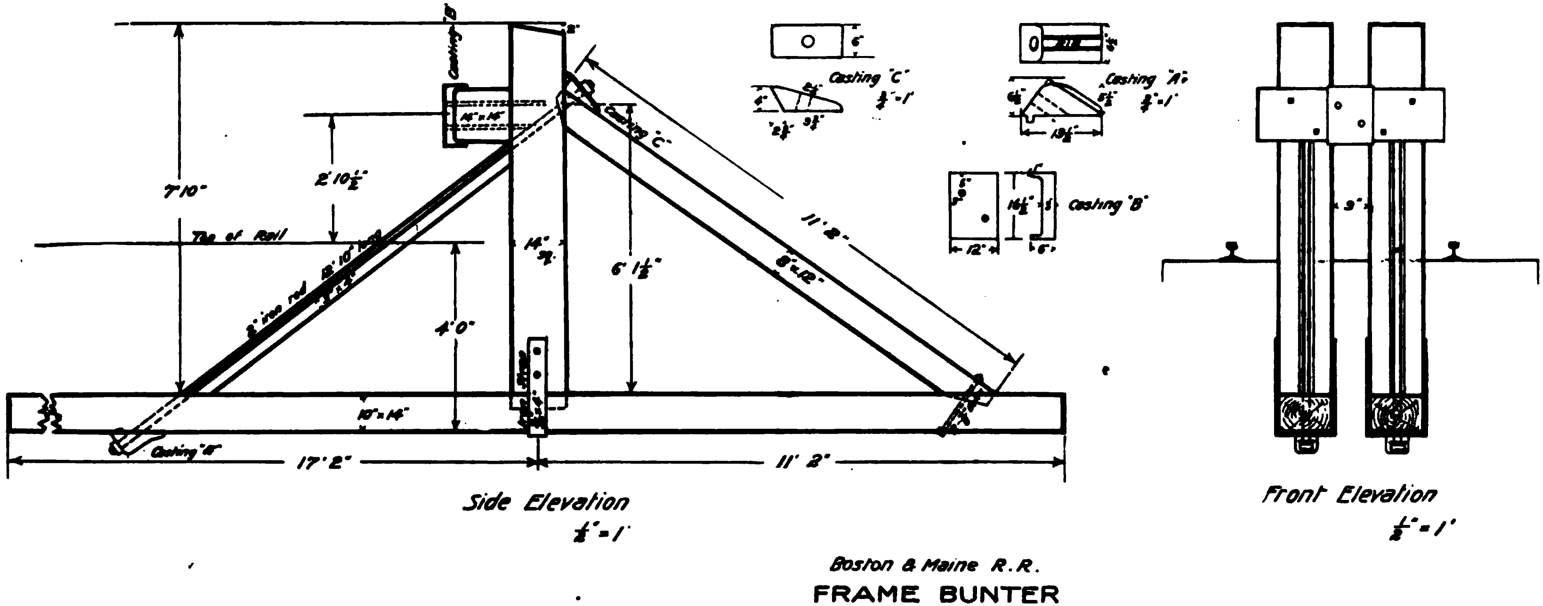


FIG. 18.—Frame Bumper, B. & M. R. R.

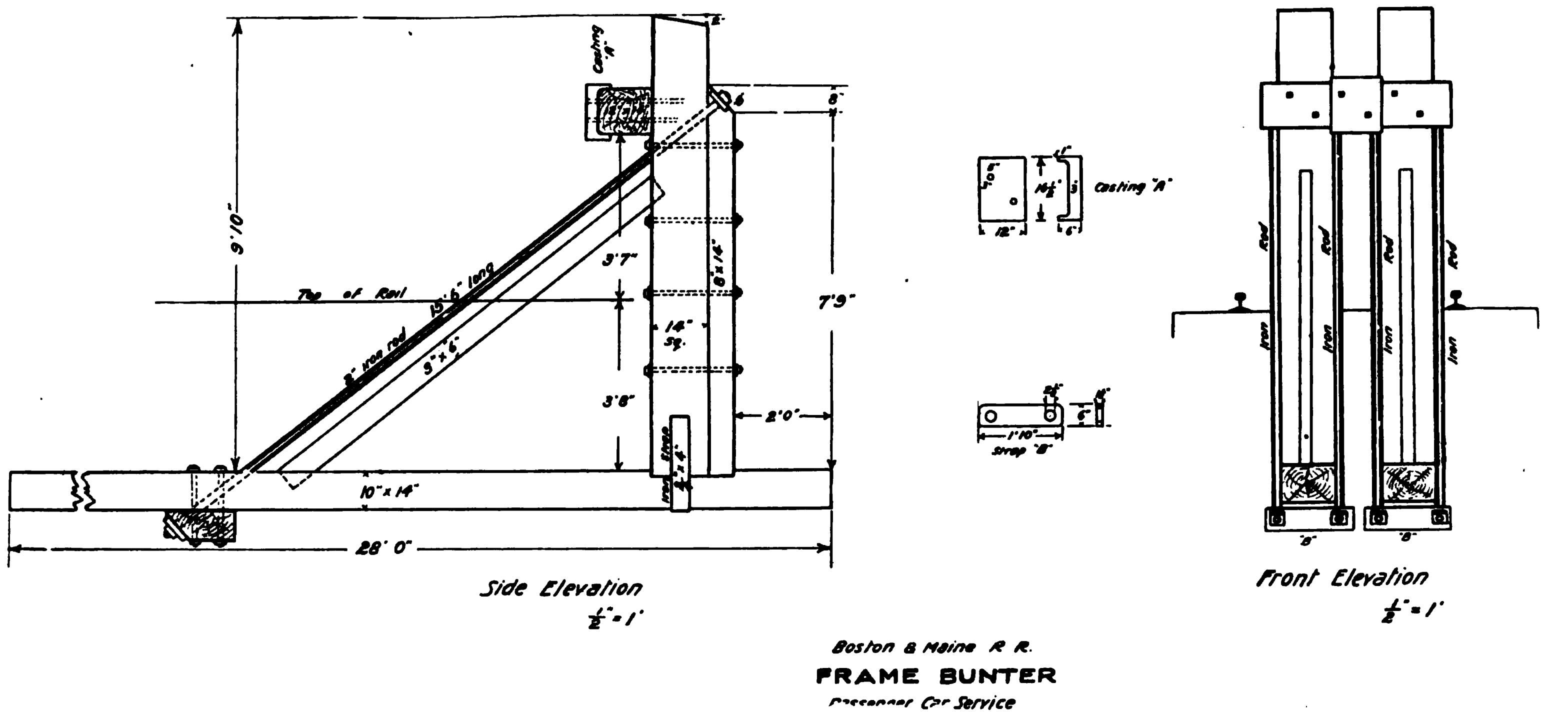


Fig. 19.—Frame Bumper, B. & M. R. R.

son that the trainmen are afraid to even approach them except at a distance. The utmost care is required in placing cars, for a slight jar will cause damage enough to bring forth a reprimand, which is dreaded by the trainmen. For general use I hardly think this bumper applicable.

The Ellis bumper, I would say, if properly installed, is very good; but, if not, frequent repairs are necessary. The weakness of this bumper appears to me to be in the rail connections.

The pile bumpers shown on the Boston & Maine plans are efficient, but as their average life is usually from five to seven years, it is questionable if they should be recommended for general use. While generally strong enough, I have known them to be broken at the ground surface when entirely new.

My experience shows that, for general use, pile bumpers have no superiority over others. We are rapidly replacing them with the frame bumper shown on accompanying drawing, in which I have the greatest confidence. We have some of these frame bumpers, still good, that have been in use 14 years, and it is rare that one is broken. The rods and braces are kept at the same angle for all heights, so that the same washer pattern can be used for all heights, whether placed four feet in the ground or on top of a wharf. The average cost of installing this bumper is $75.

The second sketch is a similar bumper for passenger tracks where back braces cannot be used on account of limited space. It has two rods to each post instead of one, and wrought iron plates instead of cast-iron washers.

J. P. Canty, Supervisor Bridges and Buildings, Fitchburg Division, Boston & Maine R. R.:

From a bridge and building department man's standpoint I presume the best bumper would be the cheapest arrangement which would stop cars with the least damage to itself. With this view, a pile of earth in most cases would answer all requirements. However, all of us are obliged to admit that the question must also be viewed from the car department man's standpoint. Here our trouble begins.

Up to the present time, on this division, we have not tried anything which answers the requirements on the ground much better than the arrangement shown on plan of Boston & Maine R. R. frame bumper presented by Mr. Hubbard. We have many of them now in use, installed previous to 1900, constructed as shown on this drawing, except with shorter sills. They gave fairly satisfactory service, but we found that often the whole bumper would be raised from its bearings by shocks, pivoting on the rear end of sill. This was prevented by lengthening the sills as shown.

While this improved arrangement gives fairly satisfactory results in stopping cars without damage to same or to the bumper, owing to the fact that the earth serves as a cushion to take up the shock, it is, of course, objectionable on account of the timber decaying on the ground line and the space required for installing it. This bumper has cost about $60, set in the ground, with timber at $25 per M. Pile bumpers have been tried by us in the

past and in almost every case have been knocked into kindling wood long before the timber has been weakened much by decay.

We have installed Ellis bumpers on trestles, passenger and freight car tracks, where for good reasons the above-mentioned frame bumpers could not be used, and although they have been disabled in some cases by the treatment given them, and have on the other hand been the cause of sending some cars to the repair shop, they have given, on the whole, very good results.

The Gibraltar bumpers have been tried by us, also, but have not given satisfaction.

In connection with this question I will state, although it may not be pertinent to the subject, that in my opinion it would be economy to leave many tracks without bumpers, which now have them, and have repairs made on cars which may have been damaged by running off the ends of rails into a pile of dirt. We all know that trainmen will use some care in handling cars on a track without a bumper. Furthermore, it often seems that it would be wiser to expend a few dollars on a broken brake-beam than to lay out $60 to $80 to replace a broken bumper.

A. Mountfort, Supervisor Bridges and Buildings, W., N. and P. Division, Boston & Maine R. R.:

I herewith send you under separate cover a blueprint of bumping post which I am using on this division, having 20 of them in service at present. I find them to be the strongest and best for freight service.

For passenger service I have the Ellis and the Gibraltar. There are two Ellis and one Gibraltar in use. These posts seem to stand securely.

W. M. Noon, Duluth, South Shore & Atlantic Railway:

We use bumpers at ends of spur tracks only when we are obliged to, and that is not very often. On the ends of our ore docks we use nothing but possibly a small piece of timber laid across the rails, as we argue if there is nothing there to stop a car the switchmen will not depend on anything, but if we put anything up they will depend too much on it, and let the car strike against the dock. The only time we have occasion to use bumpers is on merchandise docks running out in the lake, where we have sunken tracks and the higher dock extension is beyond the track. In this case, if we do not arrange something to prevent collision, they would knock the dock to pieces, as they have done; and to avoid that you will see how I have arranged it by a sketch I enclose; by putting an incline of 16 to 20 feet long and 4 feet high at the outer end and then putting a bumper at the end of the higher dock.

O. J. Travis, Fort Worth & Denver City Railway:

On the road with which I am connected we use the Ellis and Gibraltar bumping posts and find either very efficient. I think of nothing I could say further in regard to this matter, except that on coal chutes we use an inclined track instead of a bump-

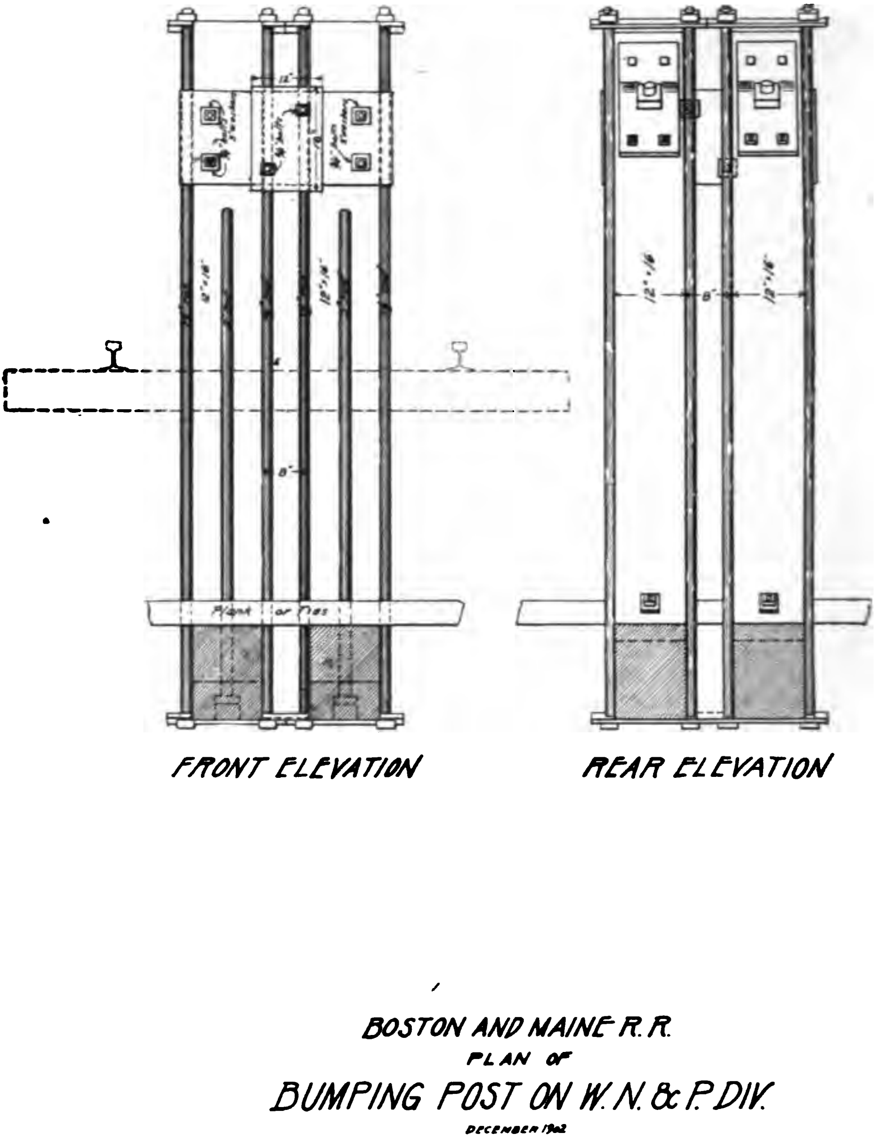


FIG. 20.—Bumping Post on W., N. & P. Div., B. & M. R. R.

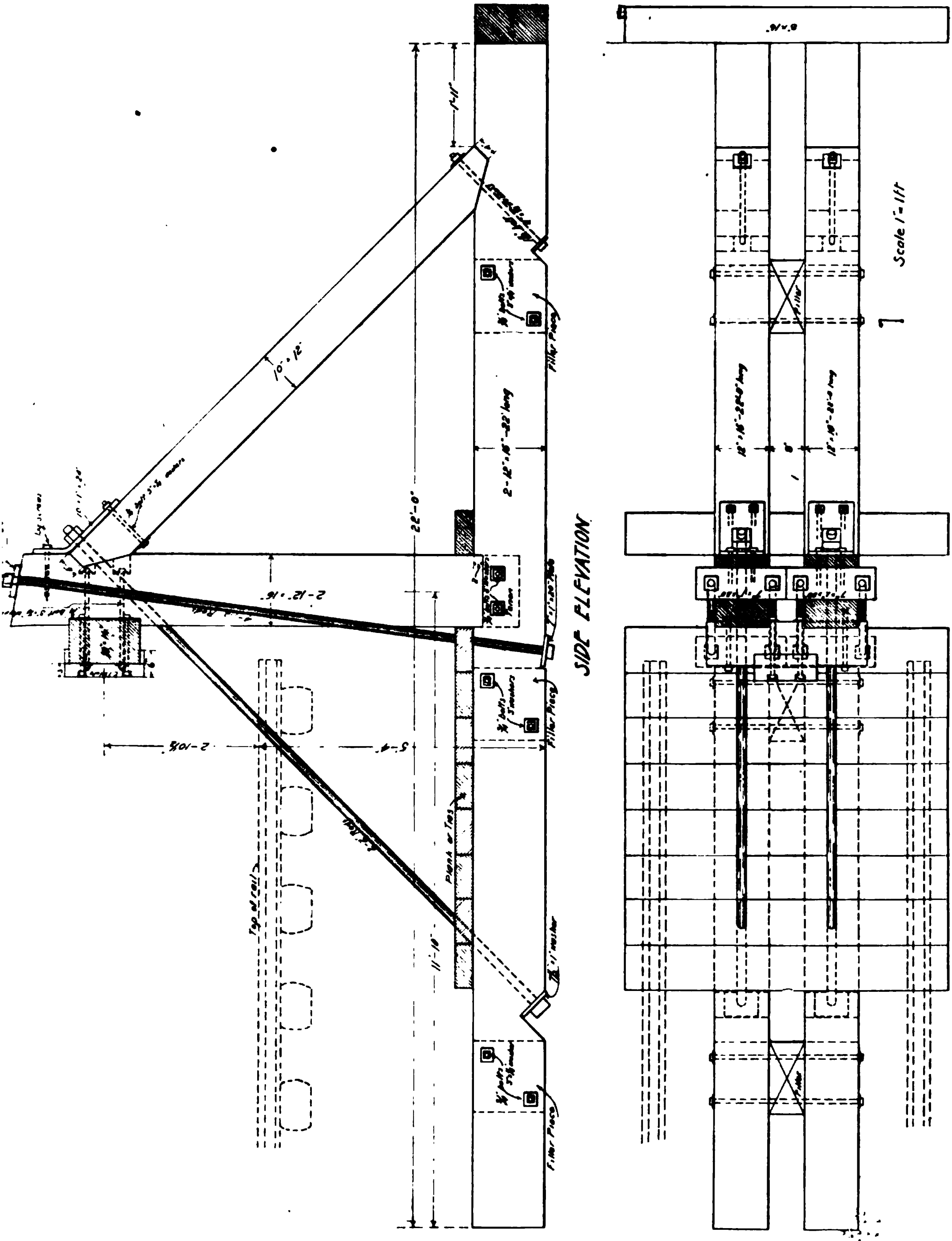


FIG. 21.—Frame Bumping Post on W., N. & P. Div., B. & M. R. R.

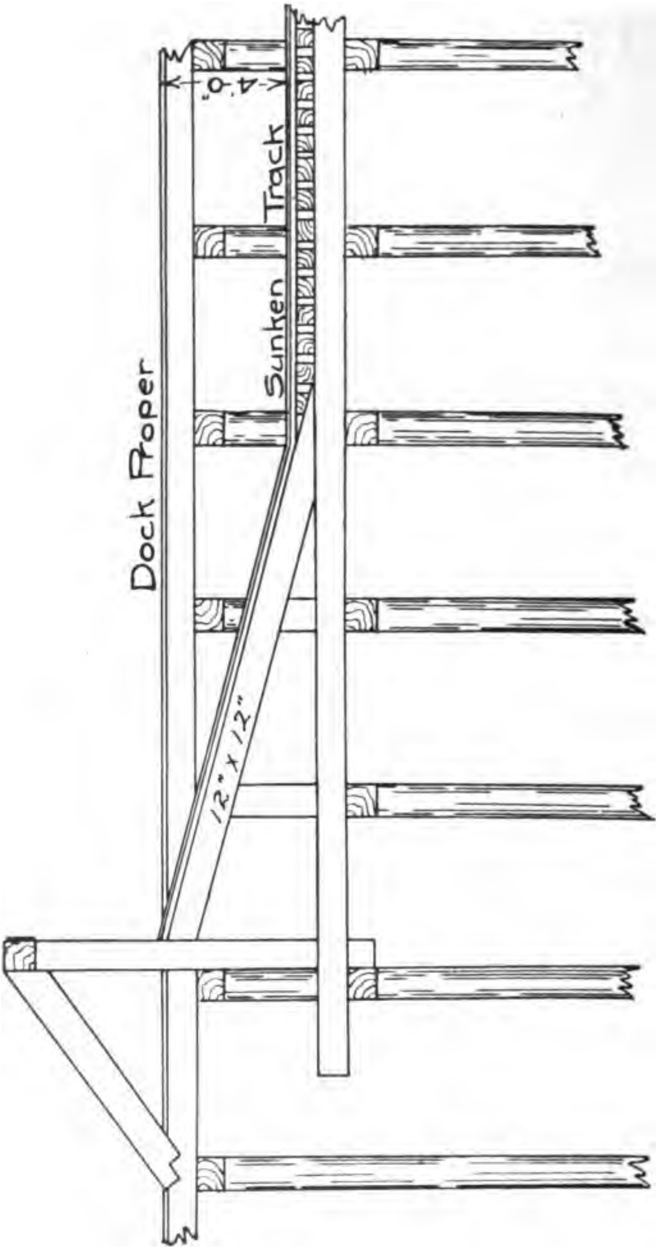
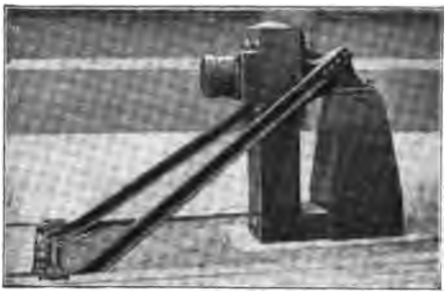


FIG. 22.—Dock Bumper, D., S. S. & A. Ry.



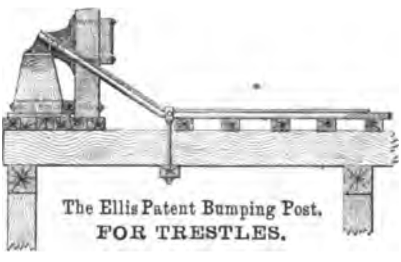


Fig. 23.—The Ellis Bumper.

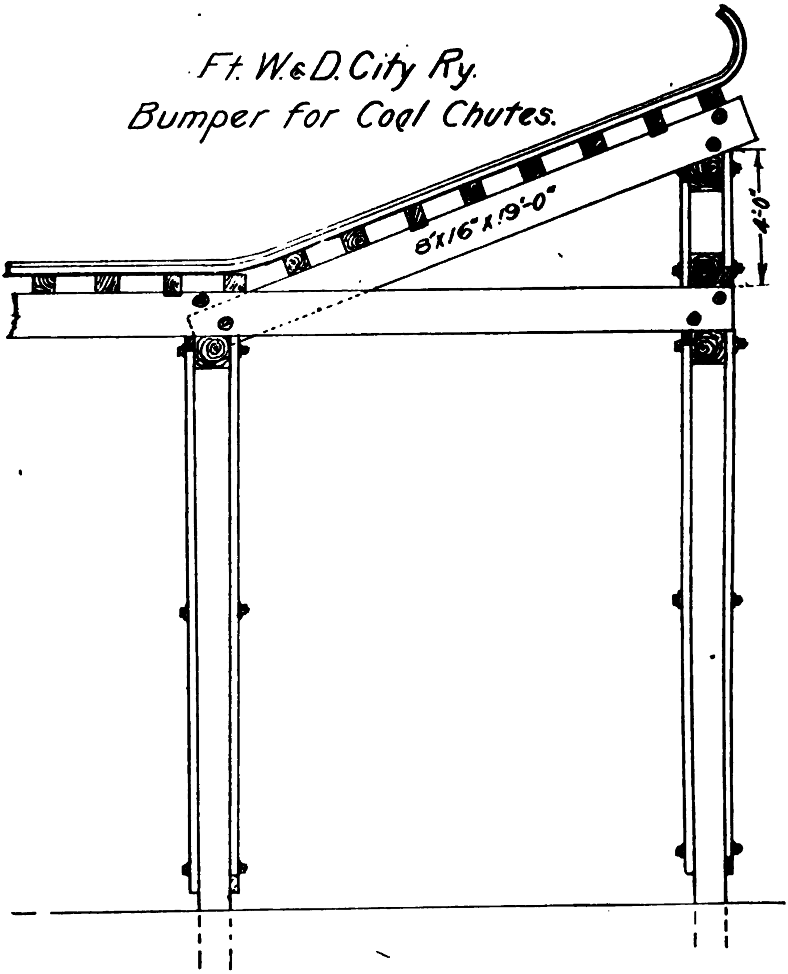


Fig. 24.—Bumper for Coal Chute, Ft. W. & D. City Ry.

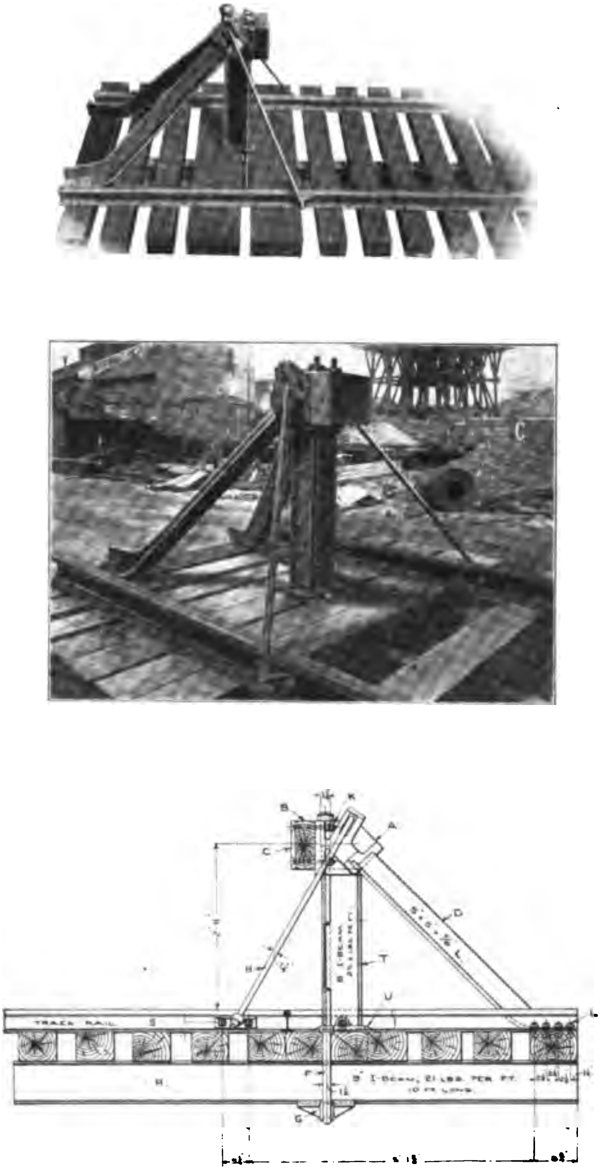


Fig. 25.—Gibraltar Bumper.

ing post, sketch of which I attach. This arrangement is, I believe, better than a bumper on a trestle, as it has not the tendency when struck by a car, to pull the trestle longitudinally, as would be the case with a buffer or bumping post.

J. S. Lemond, Southern Railway:

Where it is absolutely necessary to have a bumper, that is, at the end of spur tracks where the cars would plunge off the end of trestles, or into a chasm, the best bumper post we have used is the Ellis, though the Champion is also efficient.

At points where the end of the tracks are at a level, I think it best not to have any bumper at all; but depress the end of the track and make the end of the rails even, put three or four cross ties across at the end of the track, as per sketch attached, and when the cars are pushed off they can again be pulled on very readily. My reason for this is, in this section of the country that any kind of bumper at the end of freight tracks will give way.

J. F. Parker, California Central Railway:

I am sending you herewith a blueprint of the only kind of bumper which we have ever used on this division. While they are not as nice looking as some of the patent bumpers, they are very serviceable and give us good satisfaction. The main objection to them is that the wood, in time, decays and it is necessary to renew it.

Ed. Gagnon, Minneapolis & St. Louis R. R.:

I forward you a blueprint of the bumping post we use on our road and which we consider the cheapest we can use and the handiest to repair, and it can be repaired by the section men and set up by them, also. You are aware every bumping post can be broken, and this is the reason we have adopted this kind, so it will be easy to maintain with new material or old head blocks, which are kept on hand for that purpose. These posts are not drifted together at all, just simply laid loose in proper position. It is necessary to put the twist in the chain when set up; this makes the grip on them sure when shoving against the same.

We have several of the Ellis bumping posts and we use them in places where we want a neat looking job. The Moynihan bumping post, of which I shall also send you a sketch, is the cheapest.

The Ellis bumping post for freight, costs $75.

The Ellis bumping post for passenger, costs $90.

In other cases I approve the dirt pile at the end of the track, if it can be used and if there is sufficient room. It is the cheapest to maintain and also insures less damage to cars.

H. Rettinghouse, Wisconsin Central Railway:

I have the pleasure of sending you herewith blueprint of bumping post, as it has been in use on various railroads through different sections of this country. These pile bumping posts have proved very satisfactory and are superior in every respect to any patent bumping post on the market as to efficiency and cost of

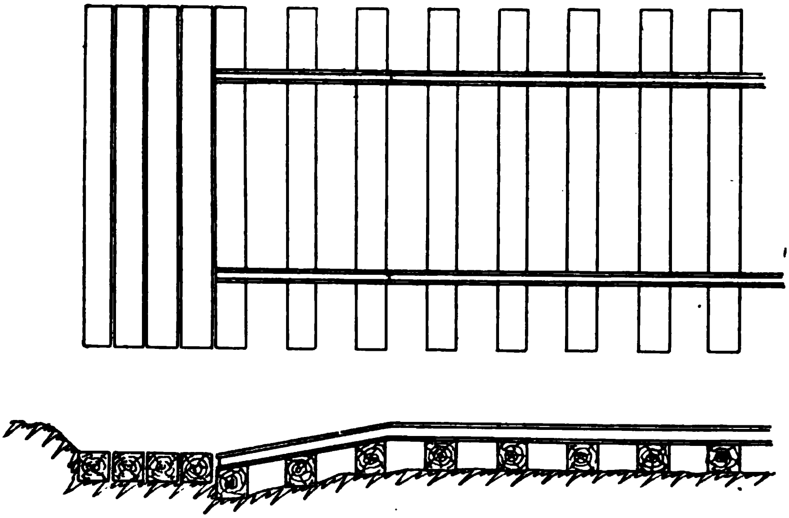


FIG. 26.—Spur Track End—Southern Railway.

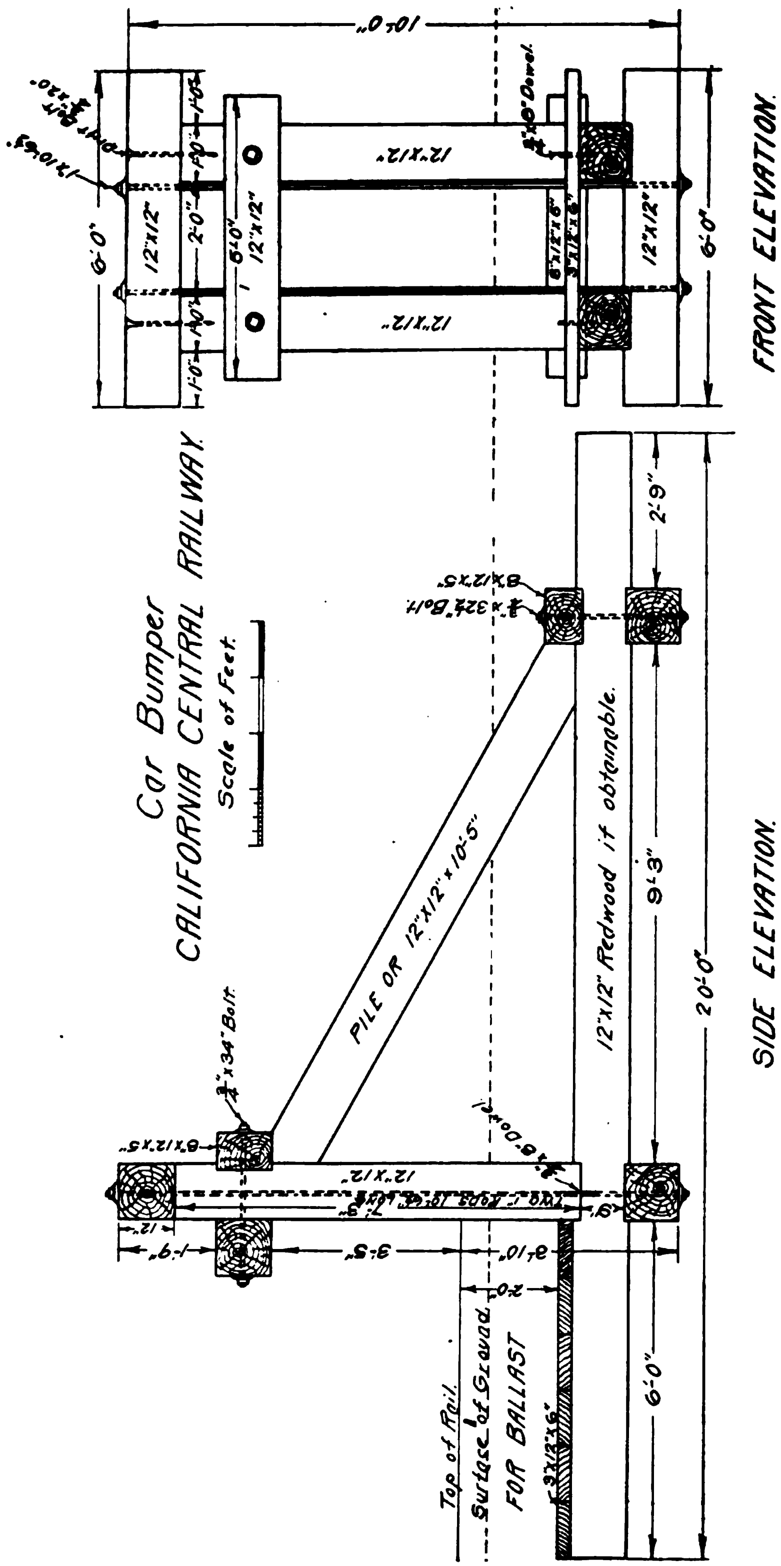


Fig. 27.—Bumper, California Central Ry.

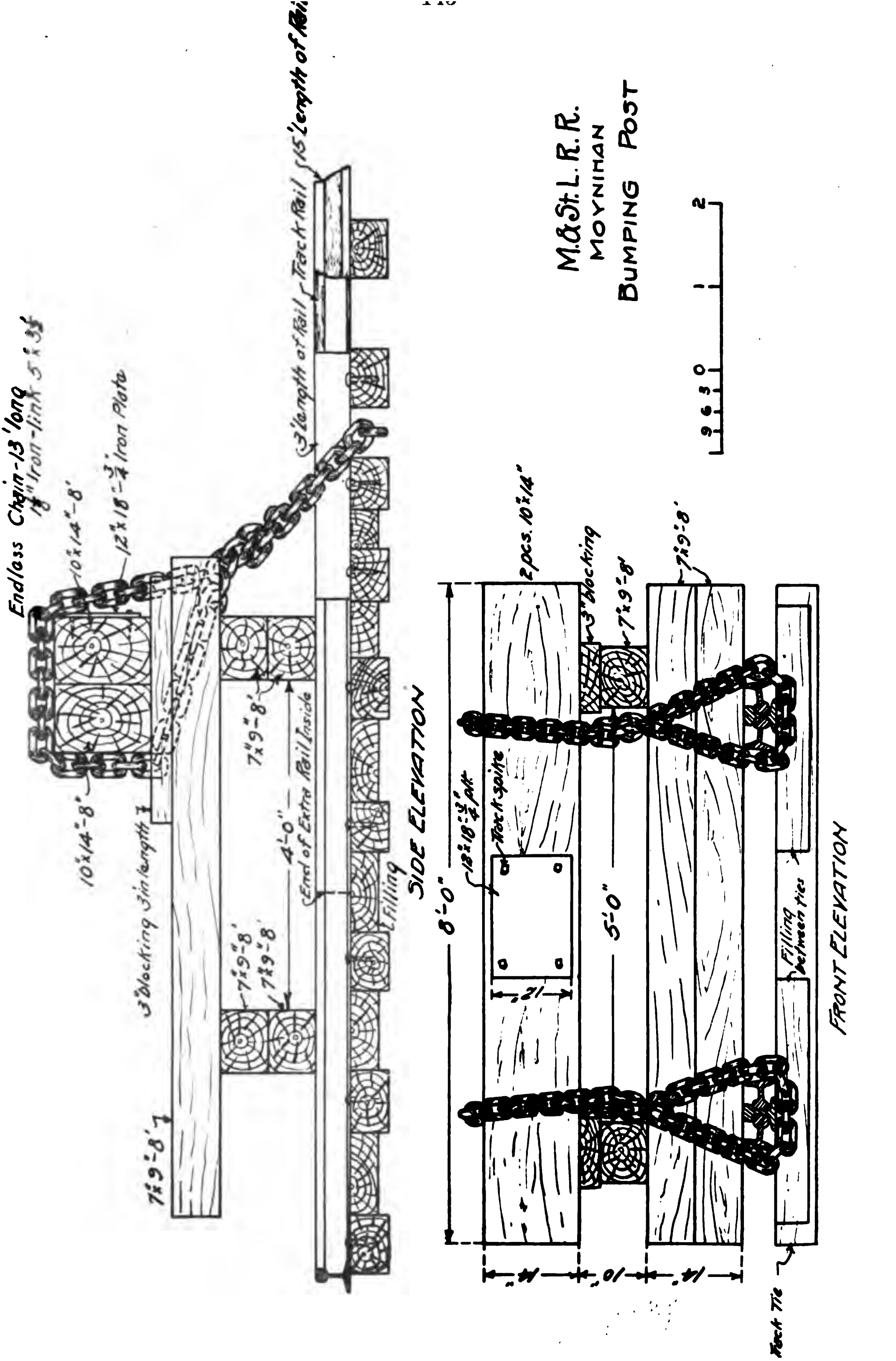


FIG. 28.—Moynihan Bumping Post.

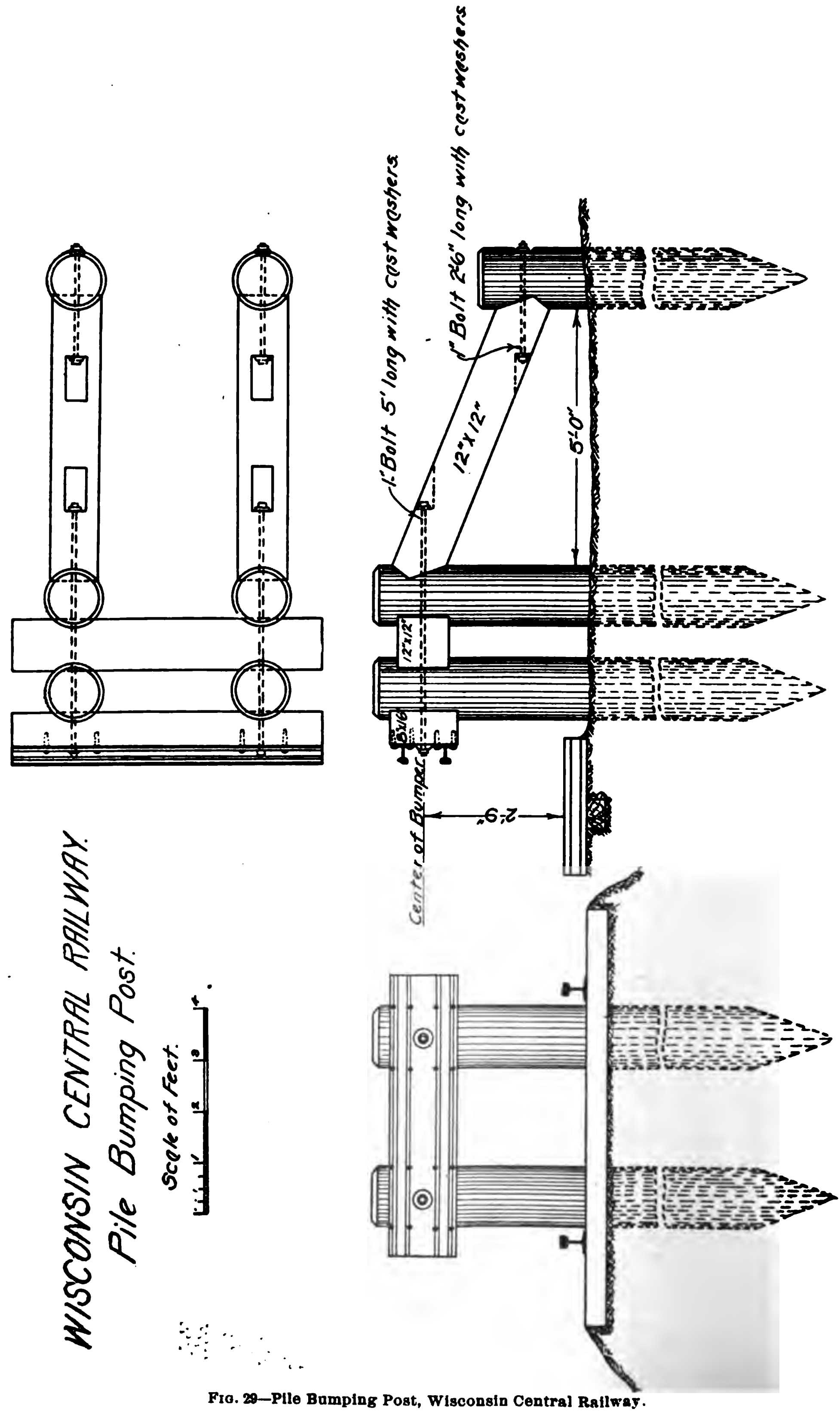


Fig. 29—Pile Bumping Post, Wisconsin Central Railway.

installation. I placed a number of these bumping posts while connected with the C. & N. W., and I found the average cost of same to be $45, $30 of which is for labor and $15 for material. We have used on this division, and are now using, the so-called Moynihan bumping post, of which I shall also send you a sketch in the near future. This bumper, I am told, has given good satisfaction and my general foreman advises that, in his opinion, this bumper is as good as the pile bumper and superior also to patented bumping posts, and is cheaper than either.

M. Riney, Chicago & Northwestern Railway:

We use two kinds: the Ellis patent bumping post, manufactured by the Mechanical Manufacturing Co., Chicago, at our terminal passenger stations for passenger coaches, which cost about $350; the Economy train bumper for stub tracks, at our out stations, that cost $90. Both have given good results and we have made some of the Economy bumpers that were broken for much less than $90.

Fig. 80.—The Stanford Patent Bumping Post.
(By courtesy of ***Engineering and Railway Review.***)

SUPPLEMENTARY REPORT

Mr. H. K. Higgins, Assistant Engineer Panama Canal:

BUFFERS FOR PASSENGER AND FREIGHT CARS.

A moving car or train is essentially a projectile and as such must be treated. The more commonly recognized forms of projectiles are fired or started in motion with the defined purpose of accomplishing destruction of some kind in the process of stopping.

A moving car or train, on the other hand, has for its purpose the accomplishment of some useful purpose during its motion and the intent is always to have the smallest possible surplus of momentum or energy remaining after the desired end is fully attained.

In so far as this is not attained it remains a projectile and this necessitates some form of buffer to stop it safely.

The necessity or occasion for buffers thus arises from the fallibilty of human judgment and there have been many and varied devises employed or proposed to accomplish the desired end.

In the early days of railroads, cars were light and speeds low, and the buffer problem was not nearly so difficult of solution as at present. Our fifty to one hundred ton cars are very different from even the twenty ton cars, with which we all or nearly all began our railroading.

The philosophy of the buffer may be briefly stated to be the absorbtion or conversion to heat of the unexpended momentum or force remaining in the train or car on its arrival, and in such manner that it will do the least possible injury to valuable property. All brakes and buffers work on this principle, or at least should do so. They differ mainly in the direction given to the destructive force and in the means provided for its absorption.

The two great primary divisions of buffers are: 1, those which themselves absorb all, or nearly all, the energy of impact and 2, those in which all, or nearly all, such energy is absorbed in the train.

To the first class belong the hydraulic buffers of the European railways, sundry patterns of spring buffers proposed and to some extent used in various parts of the world, and last but not least, the homely pile of dirt at the end of a spur track, which we have all seen so often and know so well, *and do not appreciate*.

To the second class belong most of the American types of buffers and many from all parts of the world.

In the consideration of the problem we must not lose sight of certain fundamental and immutable laws, namely, that the energy in the train must all be absorbed somewhere. That the reaction must be everywhere equal to the action, and that the work done must necessarily be at the weakest point, whether that be in the train or in the buffer.

The European or hydraulic or spring type of buffer provides a weak spot which is intended to yield and so absorb the energy.

The rigid or American type (not necessarily American) is designed to resist all the energy, and force the train to absorb it.

On general principles the spring type would seem to be most

in accord with science and common sense. There are, however, comparatively narrow limits, beyond which it seems impractical to actually absorb without damaging the force or energy involved. In European practice it has been found necessary to provide long stroke hydraulic cylinders with relief valves, forming in effect huge dash pots, into which the train forces the piston. These are used in some of the larger passenger stations at the ends of stub tracks, where accidents might be very unpleasant. On this side of the water we rely mainly on our air brakes and consider our buffers rather more an advertising safeguard than for real use. When the air does fail on our heavy trains, the buffer either goes right along with the train or else strips the tracks from under the cars and the passengers hardly know when it happens. The writer believes that in most such cases the real retarding force is the emergency air application due to breakage of pipes.

The writer's experience and observation indicate that by far the best buffer is the old-fashioned pile of dirt or gravel. That will stop any train, if the pile is big enough. If the train is not moving too fast this will do as little damage to the train as any other form of buffer. If the train is moving at high speed, of course there will be damage.

There are, however, many places where space does not permit the use of this form of buffer, and in such cases the Ellis buffer is the best the writer knows of. Its only fault is its rigidity. It stops the train after one or more cars have gone over it and is itself usually undamaged, but it would be better if the energy of the train were expended on the buffer, rather than on the cars, as, after all, the money test is the proper test and it is better railroading to wreck some sixty dollars' worth of buffers than some hundred dollars' worth of cars. It is difficult to balance the two requirements: First, stop the train and second, damage it as little as possible. Probably the Ellis comes nearest doing so of all limited space buffers. Possibly a nest of heavy car springs between post and striking plate might improve it. I would like to see it tried. One phase of the matter should not be overlooked; that is, time must be allowed for the conversion of the energy in the train. The pile of dirt allows this time to elapse and the resistance increases as the speed decreases. This is sound mechanics and is the scientific reason for the superiority of the dirt pile. In case someone has not seen it, it may be said that the dirt, sand or gravel should be, say 30 feet long, 10 feet wide and 5 high. It should be truly in line with the track and should be trued up occasionally when disturbed. It can be sodded and need not be seriously unsightly.

There are many other patterns of buffers, but the writer prefers the above to all others, especially for our heavy American trains.

DISCUSSION.

Mr. Killam.—Mr. President, it is my opinion that the method employed in the use of the bumping post in Canada does not differ materially from that which is in practice in the United States. We use almost every variety of bumping post, the Ellis, the pile, earth-mounds and the gradual lessening of speed by means of cross-ties at the end of a track. One hundred and fifty circulars of inquiry on this subject were sent out, to which I have received about fifty replies, indicating that the Ellis and the Gibraltar are the leading bumping posts, the last communication being from Mr. Higgins, the Panama Canal engineer. His ideas are fully embodied in the report which has been made and handed in, and which I now respectfully submit for your consideration.

Mr. Fake.—I would like to ask if any of the members have had any experience with the Moynihan bumper? It consists of timbers fastened together with heavy chains. We had some trouble in stopping cars and we put in one of these Moynihan bumping timbers with chains and so far it has done good service and we believe it will prove to be satisfactory.

Mr. Rettinghouse.—A sketch of the Moynihan bumper is contained within this report. We have a number of them on the Wisconsin Central and they are giving satisfaction. The sketch referred to, showing the Moynihan bumper, may be found in the report.

Mr. Cummin.—I would like to say a few words on this subject. I have still the same opinion which I expressed a few years ago when the committee investigated this subject, which is, that the best bumper is a red flag, although it might not answer the purpose in all cases. I gave my reasons at that time from my own experience, but there are a few questions that I would like to put before the members of this Association in regard to bumping posts, at this time. I have had circulars sent to me, with photographs showing

effects of cars going into a certain type of bumping posts. In all cases these photographs showed the bumping post absolutely perfect after the collision, and the cars badly injured. I have a large number of posts on the road, but that experience as shown by the photograph, has never been mine. We use a great many on coal trestles. We formerly bolted a 12 x 12 timber over the rails on these trestles, and we had very little trouble, but we finally received orders that on all new trestles built, and on all trestles not already provided with bumpers, that we must put bumping posts on the end of them. We did so, and one of them was up about a month when an engineer went up there with a string of coal cars and he struck that bumping post so hard that he sheared off the bolts and the angles for seventy-five feet behind him, and yet he maintained that he never touched the bumping post. Now it seems to me that the proper question to come before us is, whether it is wise to put up first-class posts on the end of a coal track. There is also another remark that I would like to make in regard to the Ellis passenger bumpers. I would like to obtain the opinion of the members on the effect of the rubber which is put in them as a spring? My experience has been that in six months after placing the posts in position the rubber becomes useless. We have therefore discarded the rubber altogether and have put in a spiral spring, and we consider that better in every respect, and it does the work more satisfactorily than the expensive rubber that is usually found in bumping posts.

Mr. Eggleston.—I have had some experience with the same style of bumper to which Mr. Cummin refers. At Akron, Ohio, we had five or six stub tracks which ended at an important street, where these bumpers were in use, and it is a fact that there were none of them in perfect order all the time. The cars would shear off the bolts, or they would break the rails at the anchors, and in a number of cases they tore out the anchors, and I decided that it was useless to put those bumpers in there.

Mr. Reid.—In regard to the bumping post, I think the letter to Mr. Killam which was read yesterday, from the Panama Canal engineer, is right to the point, and contains about the best reasoning I have heard yet. But back of all that is the question of the necessity of the bumping post. For instance, on an elevated trestle, ending at the side of an important track or a highway, if a car goes off it may kill several people, and there might be very heavy expense from such an accident, while if a post were there it might prevent it. If a bumping post will prevent one small accident caused by a car going over, the amount saved would exceed many times the cost of the post. So I think the post is of service where it is needed. If a track is on the ground, and it is desired to have something which will stop the cars, the old-fashioned pile of dirt is about as economical as any device in use; it will stop them, and stop them gradually. The pile post is stronger than either the Gibraltar or any other manufactured post. I have used all the different kinds and I have built pile bumping posts that train men have been unable to knock down. Some of them had seven piles in a set.

Mr. Alexander.—We have a good many coal trestles, and many places where it is necessary to have a bumper of some kind. We could not dispense with them. In coupling cars with automatic couplers the cars strike each other to some extent, and many times the coupling cannot be made by hitting lightly, and we must have a reasonably strong bumping post, such as the Ellis, Gibraltar, or some bumper of that description equally strong.

Mr. Canty.—My experience has been something like that of Mr. Cummin. We have had some trouble with patent bumpers on coal trestles, and in some cases we have taken them out and have turned up the track rails at right angles and laid a large stick across on top of the rails close to the turned-up ends. A short distance from this block (practically the diameter of a car wheel) we laid down on top of rails another stick of the same size. Both sticks were bolted

and chained securely to trestle stringers, our idea being that if the front wheels of a car struck the nearer block of the two with sufficient force to project the truck up over the first stick that these same wheels would then settle down between the two blocks and become locked there.

We have succeeded in stopping car trucks with this arrangement, and in most cases we obtain better results than with patent bumpers. However, where this arrangement has been used I have noticed that in several cases where cars have struck blocks decidedly hard, the car bodies have been partly forced over the end of the trestle, but in no case have I noticed that cars have been forced completely off, and, furthermore, we have not had trestles very much damaged. It is a simple arrangement and the cost is slight.

Mr. Eggleston.—I remember on one occasion seeing car sills bolted to the ties on each side of the rail and filled up partially with sand above the rail for about sixty feet in length, for the purpose of easing up the movement of cars in approaching the bumper, and I thought it was a very good idea. The car sills were placed about four inches from each side of the rail; the space was then filled with sand above the top of the rail.

President.—Will you please tell us if it was on a grade or on a trestle?

Mr. Eggleston.—It was on a grade.

President.—How deep was the sand on the rail?

Mr. Eggleston.—Just above the rail. It was spread along enough to have the effect of easing up the cars.

Mr. Perry.—We have on our road the Ellis bumper and others. We also have what we call a three-block bumper. Two timbers 12 x 12 and one 12 x 16 on top, bolted down to the rail. That is what we call a low timber bumper. And as one brother said, when a car strikes that, it holds the truck and the body of the car goes on, for probably half the length of the car. But I do not know of a single case where it has gone over the end of the trestle. In regard to the earth bumper, we have some of them along the sidings

of our road, but they cannot be placed on trestles. I think the bumpers that we are using now, the Ellis and the others, are serviceable, as long as used properly.

Mr. Eggleston.—I have always thought that the matter of discipline in the stopping of cars on spurs of more importance than that of mechanical appliance. I think the whole plan hinges on the matter of proper discipline.

Mr. Hubbard.—On the terminals of the Boston & Maine road, we have in use at least 200 bumpers of various kinds —Ellis home manufactured, pile, and the Gibraltars. And I believe, from my experience, that the home manufactured bumpers will stand a harder blow than any other. We have the pile bumpers; driven sometimes four and sometimes three in a cluster, and have had them broken off the next day after being completed. We have replaced those bumpers with home manufactured ones. I have some frame bumpers of home manufacture, which have been in use for fourteen years. They have been given some very severe tests. Sometimes they have backed up a train of fifty and sixty cars, and they still stand. The pile bumpers will last from five to seven years. They decay and break off very easily. The Ellis bumper, if properly installed, is, I think, an excellent one. We have quite a number of them and also the Gibraltar bumper in use.

Mr. Killam.—There is one item of which we have lost sight, and that is in reference to the rubber springs in the Ellis bumpers. In looking them over, I concluded that the rubber does not furnish an adequate cushion. It is a question whether it does very much good. I noticed that the bumpers which were being put up at St. John recently, had six spiral springs, and I think that they would do better service than the rubber generally found in the bumpers.

Mr. MacKenzie.—I have not paid any particular attention to the question of bumpers; but as a general thing we have considered the Ellis the best, and we have a good

many of them in use. I agree with Mr. Killam in regard to the superiority of the spiral springs. I remember seeing some built in that way in St. John and I think it is an improvement upon the Ellis and much preferable to the rubber spring. The springs are placed between 12 inch x 12 inch timbers and they have worked very well.

Mr. Reid.—I think there would not be any question as to the relative efficiency of the coiled springs over the rubber springs. The rubber only makes a very temporary spring. It soon hardens and becomes useless. Whereas, with a good coil spring, any amount of resistance can be obtained.

Mr. Robertson.—We have adopted in California, three or four kinds of bumpers. In one case, where we had a great deal of trouble with cars breaking them down, we put in a concrete bumper, which we find is the best one that we have discovered yet. We have been very successful with them so far.

Mr. Lichty.—I would like to ask Mr. Robertson if he will have a small sketch made of the concrete post and send it to our secretary, to be embodied in the proceedings. I think it would be interesting, and would be appreciated by many.

Mr. Robertson.—Yes, I will send a little sketch of the concrete bumper to the secretary.

Mr. Cummin.—There are occasions when a bumper is needed which will stand. I think it would be well if we could have a plan of some of the bumping posts at the terminal station of the Delaware and Lackawanna Station at Hoboken, N. J. They are constructing an entirely new terminal there,—new station train shed, platforms and bumpers. I was there a short time ago and I noticed that they were putting in a wrought iron riveted bumper. I think no train could break it down. I think it would be a good idea to secure a plan of that bumper.

Mr. Reid.—We have several at our La Salle St. Station

in Chicago, heavy iron bumping posts, and they have not yet been broken down.

President.—Is there anything further on this subject? If not, we will close it.

This completes the discussion of all the subjects for this year, excepting those of the Standing Committee.

PILE AND FRAME TRESTLE BUILDING.

(Subject No. 1.)

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

Your committee issued a circular of inquiry which was sent to every member of the Association and was very much gratified to receive numerous answers to same, which indicated considerable interest on the part of the members to assist in our work. The committee takes this opportunity to thank all contributors for their assistance.

When it was found that many of the replies to our circular contained valuable information, and all had items of general interest it was thought that more good would be accomplished if we confined our work to simply reporting extracts of the circular of inquiry and replies to same, rather than try to deduce data from the accumulated information. Although this plan necessitates a rather long report, we feel that it may result in opening up the subject to such an extent that the interest shown this year will continue for some time.

EXTRACT FROM CIRCULAR OF INQUIRY.

The committee on "Pile and Frame Trestle Bridges" requests that you aid them as far as possible by answering the following questions. It is not our aim at this time to obtain information on all kinds of trestle building, as it is rather a broad subject to treat in one paper. Our efforts will be confined simply to investigations, as outlined below, expecting that a portion of the field will be left for our successors to cultivate.

1. Do you at present or is your road planning to treat trestle timber with a preservative?

2. Is it your practice to cover tops of stringers and caps in open pile and frame trestles with any liquid preparation, roofing material or sheet metal to prevent timber from rotting? If so, please describe method used and give your opinion of the value of the protection.

3. Do you enclose piles or posts with a casing near ground line or in water to preserve same from attack of insects? If so, please give description of arrangement.

4. What precautions, if any, do you take to protect timber trestles from fire?

5. Have you any trestles in use with solid timber floors covered with ballast? If so, please give sketch showing construction, if possible, or a full description of this design.

6. Please give your opinion from a maintenance standpoint of merits and demerits, if any, of solid floor trestles covered with ballast.

7. How often do you have timber trestles inspected? Please describe fully your method of inspection.

EXTRACTS FROM LETTERS RECEIVED IN ANSWER TO CIRCULAR OF INQUIRY.

G. Aldrich, Supervisor Bridges and Buildings, New York, New Haven & Hartford Railroad Company:

1. We are not planning to treat any timber on this division, and I am not aware that our company intends to treat any timber at any point for this purpose.

2. No. The only place where we have put anything on timber to keep it from rotting is in overhead stringer bridges where they are planked for roadway. In quite a number of cases of this kind we have put a layer of tarred paper on top of the stringer between the plank and the stringer with good results. I have known cases where this has been done and at the end of 12 years the stringer was practically sound. I think this process would not work under ties, as the movement of the tie would soon wear out the paper.

3. We have no piling on this division where a casing or covering is used to preserve the same from insects.

4. The only precautions that I know this company to take is to place barrels filled with water at each end of the bridge or trestle. These barrels are buried in the ground about two thirds of the height and where the trestle is of considerable length additional barrels at intervals of 75 to 100 feet are provided.

5. No, not on this division.

6. I am inclined to disapprove the use of a solid floor trestle or bridge of any kind where it can be avoided, as it is a hard task to inspect or to reach it to repair, if built or wood or metal.

7. We have no special time fixed for inspecting a timber trestle. I have always made it a practice to go over all of the bridges on my division twice a year, once in the spring and once in the fall. I usually use a hammer. Do not believe in boring, as it weakens the timber every time it is bored and leaves a hole for the water to lay in and rot the wood. I also look over every trestle or bridge as often as opportunity will permit, when I am near any of them.

W. E. Alexander, Superintendent of Bridges and Buildings, Bangor & Aroostook Railroad:

1. No.

2. No. I think, in a very expensive structure, it would pay to use some good protection over joints or timbers.

3. No.

4. Water barrels and pails set alongside of bridge floors.

5. None. Would not approve of such floor.

6. I would not approve of ballast floor, as it would add to the chance of decay and would be in way of repairs.

7. Three times in one year and oftener when cases may need. I use a sharpened steel bar and small auger where needed, also axe or maul to sound timber.

George W. Andrews, Inspector of Maintenance, and William Graham, Assistant Engineer of Bridges and Buildings, Baltimore & Ohio Railroad Company:

1. We have several pile trestles that have been constructed with creosoted timber. As they were built within the past year, it is impossible to give any opinion as to the life of same compared with untreated timber. The cost of the material is about 75% more for the treated..

2. No.

3. No. For your information, however, I will give a description of a method used by the Baltimore & Annapolis Short Line Railroad some years ago on the piling of their bridge crossing the Severn River. This bridge is near the mouth of the river, at the point where it empties into the Chesapeake Bay. They found the salt water teredo had attacked the piling. To overcome this they built a casing around each pile of 2-inch creosoted timber and filled the same with clay. This, as far as I can learn, was successful.

4. Where we have long trestles we usually keep a watchman on same. The trestles are supplied with a number of water barrels and buckets.

5. No.

6. Not using any; would prefer not to express an opinion.

7. I answer this question by attaching hereto a copy of our General Instructions, No. 8, covering the inspection of bridges on this system. You will note that these instructions outline duties of various officers and methods of inspection, together with tables of strengths for various spans and different speeds.

Note.—It being the desire to carry on investigations in regard to the details of inspection by the bridge and building department foreman rather than the system of general inspection, as outlined by the circular referred to under question number seven, it was thought advisable not to incorporate circular in our paper, although succeeding committees on this subject may find considerable valuable information in same on points which they may desire to cover, especially the tables on sizes of timber stringers for different weights of engines for various spans.

L. J. Anderson, Foreman of Bridges and Buildings, Chicago & Northwestern Railway Company:

1. The C. & N. W. Ry., on this division, is planning to treat trestle timbers with a preservative, but has not done so as yet.

2. A few years ago we covered the stringers on some of our bridges with sheet iron, but now we cover the top side of all trestle timbers with prepared paint. Both slightly prevent the timber from rotting and, furthermore, they answer as a fire protection.

3. No.

4. We have water barrels on all bridges, except where the structure is low and a live stream of water is running the year around. In winter when the weather gets cold we empty water from barrels.

5. No.

6. No solid floor trestles on this division.

7. Twice a year, in the months of April and September, we make an inspection.

R. Angst, Chief Engineer, Duluth & Iron Range Railroad Company:

1. We do not at present, nor are we planning to, treat trestle timber with a preservative.

2. We do not cover tops of stringers and caps with any liquid preparation, roofing material or sheet metal to prevent timber from rotting.

3. We do not enclose piles or posts with a casing near ground line, or in water, to preserve same from the attack of insects.

4. We provide water barrels, placing same outside the guard rails, not to exceed 50 feet apart, on both sides of trestles. We add a pound of salt for every four gallons of water and make it the duty of the track men to keep those barrels filled during the summer season.

5. We have no trestles in use with solid timber floors covered with ballast.

6. I am in favor, from a maintenance point, to have solid floors on trestles and cover same with ballast, provided the timber can be properly treated to give it reasonable life. As protection against fire I have found No. 18 corrugated steel, preferably galvanized, a very effective and fairly inexpensive remedy.

Until last spring, the nearest treating plant to this point was in Chicago, 450 miles distant, which made the treatment of timber for various purposes practically prohibitive, even if a man was willing to take the chances of the Wellhouse process. At present a new creosoting plant has been put in operation about seventy miles from here and, if the results of the treatment come up to a fair standard for creosoting, it will be kept extremely busy by the railroads of the district.

Walter G. Berg, Chief Engineer, and F. E. Schall, Bridge Engineer, Lehigh Valley Railroad:

1. No. My opinion is, however, that if prices of timber keep on increasing, trestle timbers will soon have to be treated for preservation.

2. Not generally. We have used galvanized sheet iron to cover stringers and caps to prevent timber from catching fire. In my opinion sheet iron covering will prevent fire from starting, but will not give a good protection against the rotting of timber.

3. No. We are using some creosoted piles in structures such as piers which are expected to be maintained in timber for years to come.

4. None, generally, excepting keeping barrels of water on, or at the ends of, trestles. We have used some fireproof paint for protection against fire, but have had no experience as to its value.

5. No.

6. Have no experience in this kind of structure.

7. All our structures are inspected continually, each division employing a bridge inspector, who goes from structure to structure making a special inspection of such structures as may require it by their condition or location.

J. S. Berry, Superintendent of Bridges and Buildings, St. Louis & Southwestern Railway Company:

1. We do not at present and we are not preparing to treat trestle timbers with any preservative.

2. It is not our practice to cover tops of stringers and caps in open pile and frame trestles with any liquid preparation, roofing material or sheet metal to prevent timber from rotting.

3. We do not enclose piles or posts with a casing near ground line, or in water, to preserve same from an attack of insects.

4. By cleaning weeds and all rubbish away from around the trestles is the method we use for the protection of timber trestles from fire.

5. We have no trestles in use with solid timber floors covered with ballast.

6. I do not consider it good practice from a maintenance standpoint to erect solid floor trestles covered with ballast.

7. Every three months our bridge inspector makes a trip over the road on velocipede car and inspects all bridges.

J. S. Browne, Division Engineer, New York, New Haven & Hartford Railroad Company:

1. Not that I am aware of.

2. No protection used.

3. No.

4. None.

5. We have no ballast floors on trestles.

6. I think they would be more expensive to maintain than open floor trestles, on account of the ballast holding dampness.

7. Timber trestles are inspected at regular intervals, depending on the location, and usually by boring into the timber.

J. C. Beye, Resident Engineer, Union Pacific Railroad Company:

1. The Union Pacific uses creosoted piles in bridges requiring piles 34 inches and longer, and uses creosoted piles, caps and 4-inch plank on top of stringers in all pile and trestle ballast floor bridges.

2. We do not protect stringers and caps as outlined in this question.

3. No.

4. The top of pile and timber trestles is covered with a floor of 1-inch fencing between the guard rails. On top of this floor is a 2-inch layer of slag, broken stone or gravel. Long bridges are provided with pails and barrels filled with water, placed at suitable intervals.

5. Yes. Attached please find blueprint showing ballast floor for pile and trestle bridges. Our plans call for single, double or more track bridges. (See plan of ballasted floor trestle bridges, Union Pacific Railroad.)

6. The ballast floor permits better and easier maintenanec of line and surface of track in the immediate vicinity of the bridge, affords a better protection to timber and pile trestles from fire, and eliminates the noise due to trains over ordinary bridges. It is a far more expensive bridge and examination is also more difficult and expensive than the original trestle bridge.

7. Timber trestles are inspected twice a year, the annual inspection being made by an engineer and the supervisor of bridges and buildings. Every stick of timber and every pile is thoroughly examined and a record made of the condition of same in inspection books according to form, so that inspection books show exact condition of each bridge at the time inspection was made. Second inspection is made by the foreman who makes repairs to the bridge. He goes over the whole structure, examining same, and makes all necessary repairs according to schedule, which is gotten out on the joint inspection by the engineer and supervisor, and all other repairs, keeping the bridge always in safe condition.

M. Bishop, Master Carpenter, Chicago, Rock Island & Pacific Railway:

1. We do not.

2. We do not.

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su

3. We have water barrels installed.

4. We have none.

5. We have none.

6. I have had no experience in this type of bridges.

7. We make inspection twice a year, and once a year send the gangs over the division to do repair work and remove all decay from piling and test for rotten caps or stringers. This is done so that when the master carpenter and engineer make their inspection it exposes all weak defects and expedites their inspection.

A. L. Bowman, Bridge Engineer, Central Railroad of New Jersey:

1. Yes, we treat piles and pile trestles.

2. No.

3. No.

4. We have water barrels on our short trestles. On our long trestles across Newark Bay we have men patrolling night and day.

5. No.

6. I think a solid floor trestle covered with ballast makes a very satisfactory roadbed, but expensive.

7. We have two general inspections—spring and fall—with current inspection by the maintenance of way forces. I should say the timber trestles get a thorough inspection four or five times a year.

The answers to questions 1, 2, 3, 4, 5, and 7 refer to the practice on the C. R. R. of N. J. The answer to 6 is my own personal opinion.

Moses Burpee, Chief Engineer, Bangor & Aroostook Railroad:

1. No.

2. No.

3. No.

4. By clearing the ground.

5. No.

6. Think neither would last so long as ordinary timber floor, nor ride so well. Do not think safety would be increased thereby.

7. Twice a year or oftener.

F. L. Burrell, General Foreman of Bridges and Buildings, Chicago & Northwestern Railway Company:

1. We are not treating trestle timbers with preservative on this section of the C. & N. W. About two years ago we painted the piles two feet above and below the ground line with asphalt, on

one or two bridges, and in one case painted the stringers, but at this time am unable to say that it was of any benefit. (Think it was not.)

2. This is partially answered above. Will say further that we do not use metal covering at this time. We had a trestle bridge that was covered at the joints with a zinc covering about eighteen years ago; took it off last year and found the covered part in a very good state of "health." It would be too expensive to cover a whole bridge in exposed parts, though.

3. We do not enclose piles or posts.

4. The only precaution we take is a lot of barrels filled with water to use in case of fire. This is not much of a protection, as we have to depend to a great extent on the section men to keep the barrels filled, and this is not always attended to.

5. We have no bridges with solid floor covered with ballast. As to my personal opinion, I do not think they would be a success, as they will hold the moisture in such places as will induce decay; also, when repairs are to be made to the joists, caps and stringers, the ballasted floor will be in the way and, to make proper repairs, will be very expensive.

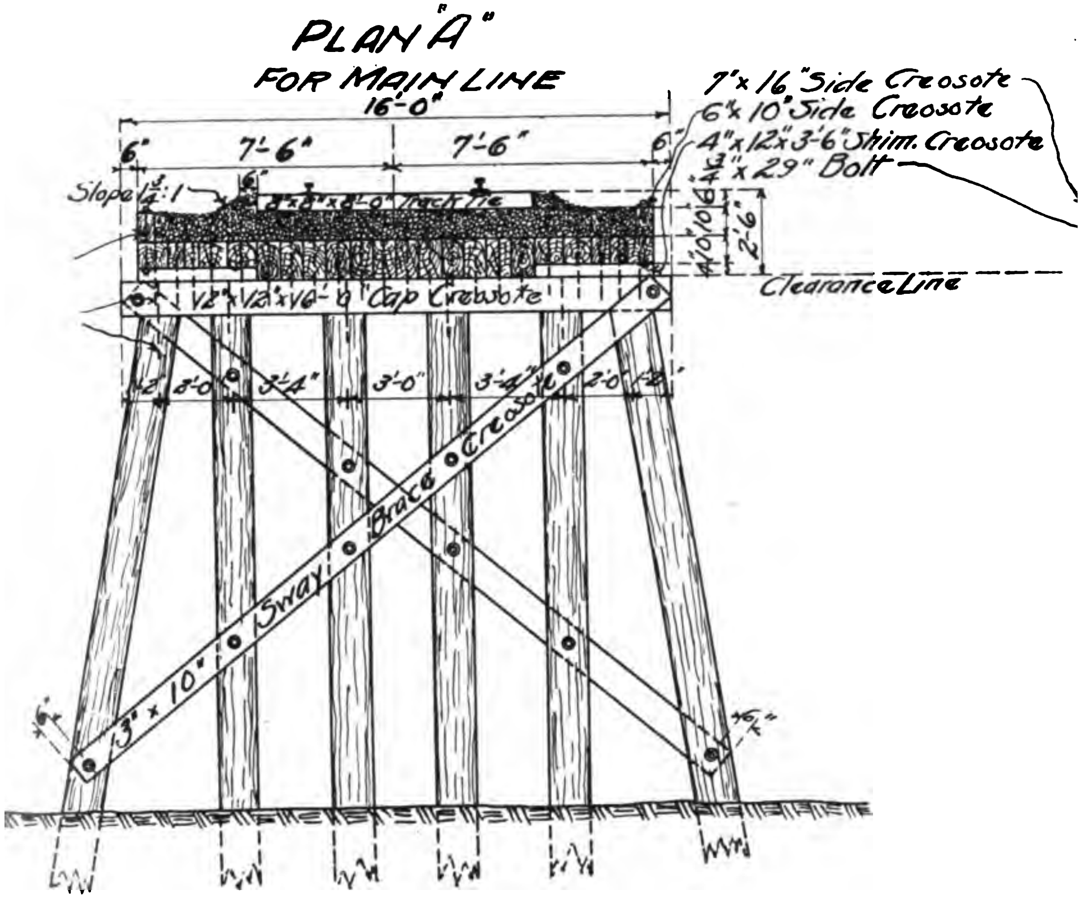
7. Semi-annually. Fall inspection by the division engineer and superintendent of bridges and buildings. Spring inspection by the superintendent of bridges and buildings. Both of these inspections are made with a four-wheel gasoline motor car (hand car size), division engineer, two bridge men and myself examining all parts of the structure and making up the annual schedule from this inspection. In spring, I make the second inspection, checking the first and adding such work as may be considered actually necessary for the safety of the traffic.

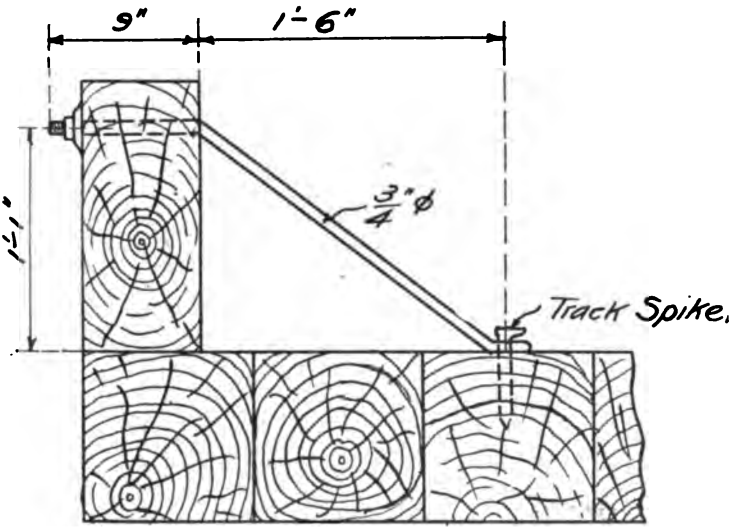
S. F. Clapp, General Foreman of Bridges and Buildings, Gulf, Colorado & Santa Fé Railway:

1. The G., C. & S. F. Ry. has for the past eight years been using treated material, the greater portion having been the Zinc Chloride process, a small portion, however, being creosoted. At the present time all bridge material, as well as any material that comes in contact with the ground, has been creosoted.

2. We are not at the present time using any standard pile and trestle bridges, except ballast deck or solid timber floor bridges, but plans for pile and trestle bridges provide for a protection of galvanized iron over both stringers and caps, turned down one inch over both sides and ends of stringers and caps, fastened with 1-inch or 1¼-inch galvanized iron nails. The only portion of any structure that we have covered in this manner is the caps, cross blocks and wall plates upon two pile piers for an iron girder. This is creosoted timber, and as it has only been in place one year, cannot pass upon the protection features.

3. No casing is used on piles at water lines. At Galveston Bay, where timber is destroyed by the teredo, piles are treated with 24 pounds of creosote per foot and this treatment has given good results on a test of 11 years.





SIDE BRACE FOR PLANS D.

Fig. 32.—Ballasted Wooden Trestle, Santa Fé System.

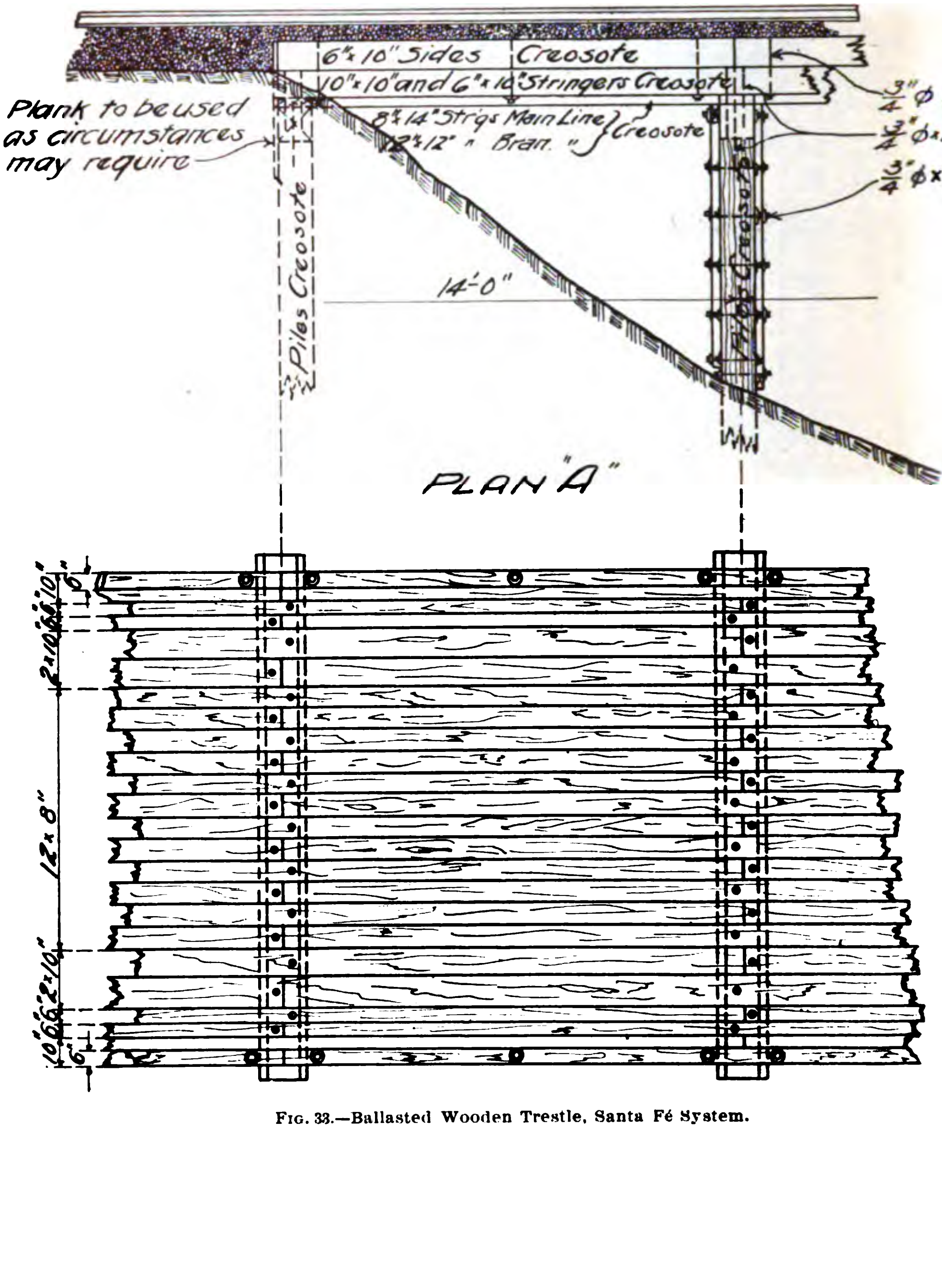


Fig. 33.—Ballasted Wooden Trestle, Santa Fé System.

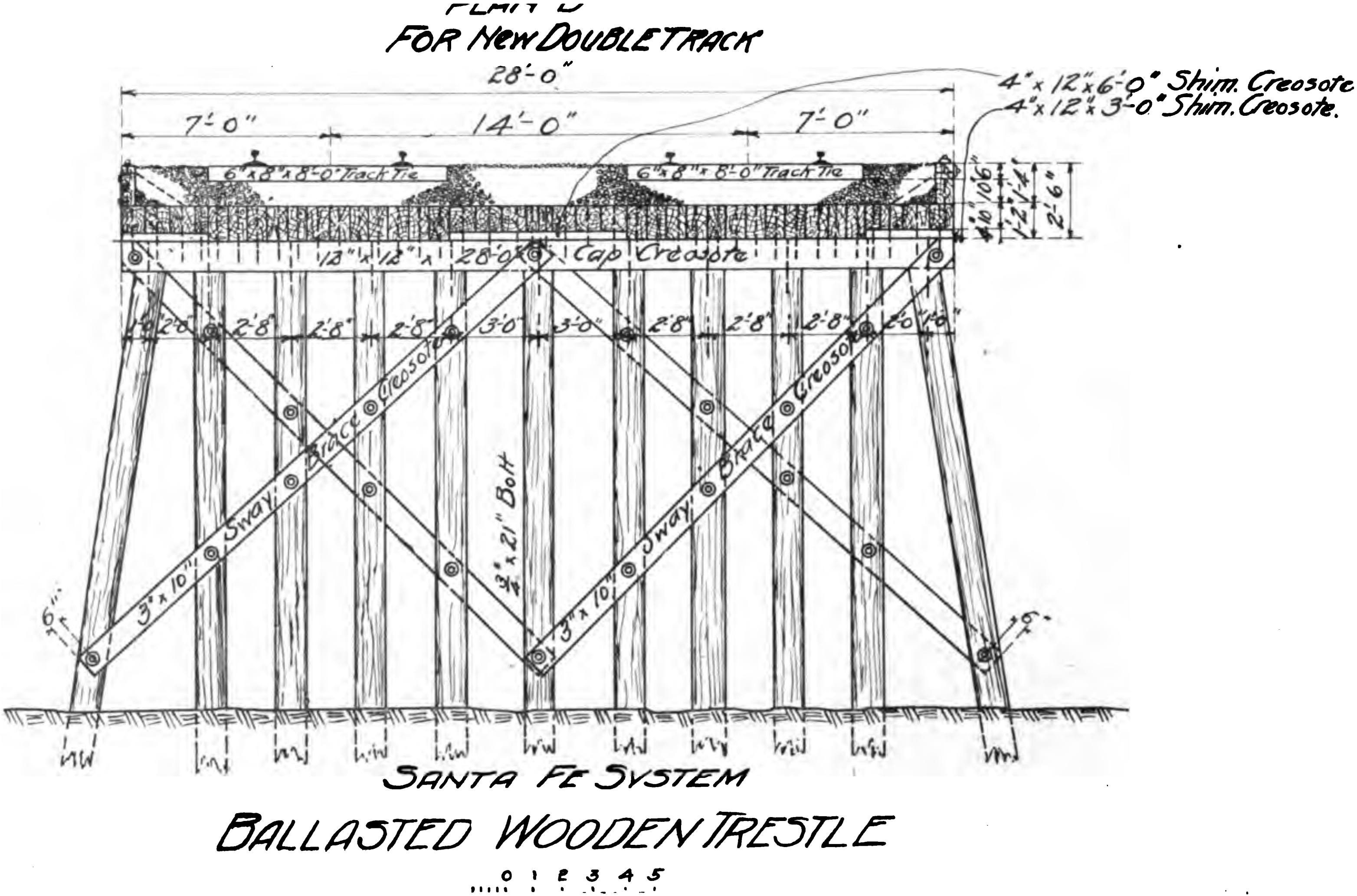


FIG. 34.—Ballasted Wooden Trestle, Santa Fé System.

4. Owing to the fact of all engines on this division being equipped as oil burners, no protection against fire is used.

5. All pile and trestle bridges replaced are renewed with ballast deck structures. (See plan of A., T. & S. F. Ry. ballasted wooden trestle.)

6. Am very favorably impressed with the ballast deck bridges as tending toward economy of maintenance. The line and surface is kept up by the section force, and on bridges up to 100 feet in length at probably no greater cost than it would require to keep up the track at each end of a pile bridge. The most serious factor to be taken into consideration will be the matter of rebuilding. We have not reached this point with any of our bridges, but when reached it will be an expensive operation.

7. Bridge inspection is made by general foreman of bridges and buildings during May or June to determine the renewals required for the following year, and division inspection about each three months with foreman, to decide upon immediate repairs. General inspection is made by general superintendent, chief engineer, division superintendent, general foreman of bridges and buildings and roadmaster, about October, who, at that time, pass upon recommendations made by the general foreman of bridges and buildings, deciding class of structures to be erected and method of inspection. Ties, stringers and caps are inspected from deck of bridges for visible defects at all points of contact and when thought necessary are sounded with augurs or inspection bars. Caps are then examined with care at tops of piles and posts for signs of failure. Piles, posts and sills are uncovered below ground line and sounded for defective spots. Trestles on pile foundations are examined with care at contact points between sills and piles. Inspection bars are used mainly for testing timber. They are made of ⅝-inch steel, diamond point on one end, with small shovel on opposite end for digging purposes.

A. O. Cunningham, Chief Engineer, Wabash Railroad Company:

1. No.

2 No.

3. No.

4. No.

5. No.

6. Do not believe that trestles should be made of solid floor with ballast unless the timbers are treated, because the necessary covering to hold the ballast must produce rot in the tops of the stringers, much more so than in an open floor trestle. If the timber is treated then the cost must be greater, and while the writer has never made an estimate of the difference in cost between such a structure and a permanent one, it would seem to him that there would be very little difference.

7. The foreman of bridges of each district is responsible for all timber trestles on his territory. He visits these as often as

he thinks necessary, the older trestles receiving, of course, more attention than the later ones.

W. S. Dawley, Chief Engineer, Chicago & Eastern Illinois Railroad Company:

1. We have as yet done nothing in the way of treating bridge timber. We have bought one very small lot of creosoted timber only. There is no movement on hand to adopt treated timber in the immediate future.

2. Very little, if anything, is done in the way of special protection to either caps or stringers. At a few points galvanized iron has been placed on top of the stringers, more as a protection from fire than anything else.

3. Nothing of this kind has been done.

4. No special precautions other than a barrel of water and keeping the rubbish well cleared away, and an occasional covering of some special structure, where more than the usual amount of coals is dropped from locomotives.

5. We have none.

6. From what I have read I would be inclined to consider solid floor structures desirable. I have no practical knowledge of this plan.

7. In the past a thorough inspection by the master carpenter in person has been made twice a year. At the present time an inspector sees each structure once in 30 days. The boring of timber, etc., is resorted to when the age is such as to make it seem desirable to do so.

H. H. Eggleston, Supervisor, Bridges and Buildings, Chicago & Alton Railway Company:

1. We use treated timber in our trestles.

2. We do not cover the tops of stringers or caps in our trestles with any liquid preparation or roofing material or sheet metal, except where we have a solid ballast floor, and this, of course, is entirely covered with ballast.

3. We do not enclose piles or posts with a casing near ground line or near water to preserve same from attacks of insects, as there are no insects in this country which destroy timber.

5. We have solid timber floor bridges covered with ballast, and I herewith enclose a blueprint showing the construction of same. (See plan of standard pile trestle with ballast floor of Chicago & Alton Railway.)

6. I believe the solid ballast floor of creosoted timbers, piling included should be creosoted, will last without any repairs, except to replace track ties, 30 years or more.

7. We inspect our timber trestles every month, a man going over the road with a speeder and carefully examining all parts of the bridges by boring holes with an auger in the timber and digging around the piling to find out if they are defective.

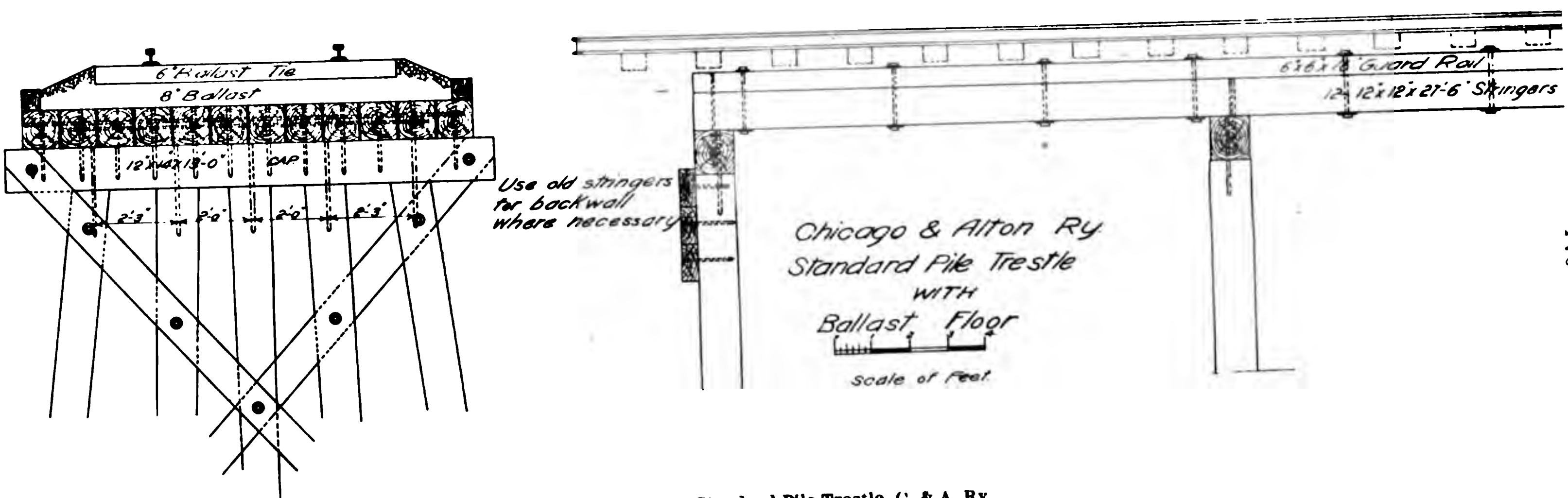


Fig. 35.--Standard Pile Trestle, C. & A. Ry.

L. F. Goodale, Engineer of Maintenance of Way, Chicago, Burlington & Quincy Railway Company:

1. No.

2. No.

3. No.

4. We periodically clean weeds and debris away from our wooden bridges and on some parts of the road cover the wood work with sheet iron and, in some cases, put a small layer of broken stone on top of this.

5. We have one such bridge constructed jointly with the Santa Fé. It was built by the Santa Fé and conforms to their standard.

6. Although I have had no experience at all with ballasted deck trestles, I think we could better afford to put in permanent structures rather than these ballasted deck trestles.

7. Timber trestles are inspected irregularly by the master carpenter three or four times each year, or more if necessary, and by the bridge foreman probably once a month.

V. K. Hendricks, Division Engineer, Baltimore & Ohio Railroad Company:

1. We do not at present treat any trestle timber with a preservative.

2. We do not ordinarily cover the tops of stringers and caps in open pile and frame trestles with any liquid preparation, roofing material or sheet metal.

3. We do not enclose piles or posts with any casing near the ground line for preservation against attack of insects.

4. As a precaution against fire we have at least one barrel of water at each bridge, and on long bridges have a barrel of water about every 100 feet on alternate sides of the trestle. We have endeavored to keep a water bucket hanging down inside of the lid in the water barrel, but find it impossible to keep buckets in such places.

5. We have no trestles in use with solid timber floors covered with ballast on this division.

6. I believe solid floor bridges are much more economical from a maintenance standpoint than bridges without solid floor; this, however, refers to concrete steel bridges. If this question is intended to cover the construction of solid floor trestles of wood, either treated or untreated, I should hardly think it any more economical, if as economical, as ordinary trestle.

7. All timber trestles are supposed to be examined at least once every six months by the master carpenter, and at such frequent intervals between times as may be necessary; this being governed by the local conditions. All carpenter foremen endeavor to go over bridges in the vicinity of where they have any work at all times, in addition to master carpenter's inspection.

A. B. Hubbard, Supervisor, Bridges and Buildings, Terminal Division, Boston & Maine Railroad:

1. We are using what is known as Letteney's Preservative, which is applied with an ordinary paint brush, the material itself having about the consistency of paint. About twenty-five years ago the City of Boston applied this preservative on the planking of one of their bridges and when the bridge was repaired about four years ago, the plank was found in excellent condition.

2. No.

3. We have piling near the Union Station that has been driven several years, upon which the worms had begun to work, and to save them we had piles encased in cement from six to eight inches in thickness. This has been done about two years, and whether it has had the desired effect or not I am at present unable to say, as we have not removed the casing from any of the piles.

4. Nothing except to keep barrels of salt water convenient which, in case of fire, would allow immediate attention, and possibly prevent serious results.

5. I have no doubt but what trestles covered with solid timber, then a good coating of clay, to prevent fresh water reaching timber, then gravel upon which paving or ties could be placed, would act as a preservative, particularly when timbers are placed low enough to allow tide to wet them once in 24 hours at least. I know of one instance where wharf was repaired after being in use 30 years, and the timber covering under dirt was taken up and found in such good condition that it was put back again. This was in 1874, making 62 years' service for this timber, and it is in fair condition now.

6. From a maintenance standpoint, I would not recommend solid floor trestles, because when repairs are to be made it takes considerable more time and is more expensive than when left uncovered, so it can be seen at all times. Now, in all instances where repairs are made to trestle and where ballast is used (except in driveways) we are leaving out the ballast.

7. We have no stated time for inspection, but usually about twice a year an examination of trestles is made, which is done by boring.

K. S. Hull, Superintendent, Texas & Gulf Railway:

1. All material used in our permanent pile and trestle bridges is being creosoted.

2. We have some bridges where all heart, long leaf yellow pine stringers and caps were used. In open pile and frame trestles we cover with No. 28 galvanized iron. We have found that where the stringers and caps were covered by this method it will prolong the life of the timber at least three years.

3. Do not enclose piles or posts with a casing.

4. Long trestles are supplied with water barrels; all locomotives on this line use oil as fuel.

5. We have been putting in trestles with solid timber floors with 10 feet of rock ballast for several years. All material used in this class of bridges is creosoted. (See plan of A., T, & S. F. Ry., ballasted wooden trestle.)

6. The cost of maintenance of our ballast deck bridges is practically nothing. About 12 months after these bridges are completed we find it necessary to send a small gang over the road to tighten up the nuts on the sway braces and guard rail bolts.

7. Each division foreman is supposed to make an inspection of the bridges on their respective district every 30 or 60 days. The general foreman of bridges and buildings makes an inspection twice a year.

H. Isben, Acting Bridge Engineer, Michigan Central Railroad Company:

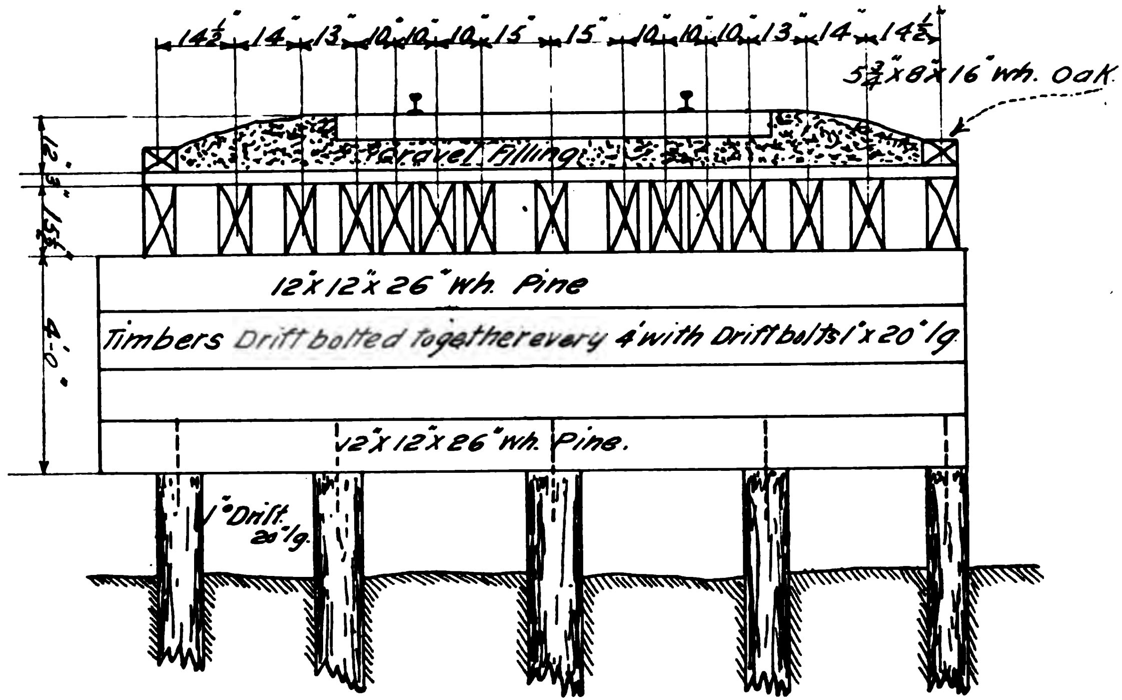
1. We are not at present treating trestle timber with preservative, and have only done so in a few special cases within the last couple of years as an experiment. On account of the high prices of timber, and difficulty in getting good timber, we are, however, thinking of experimenting more on this line.

2. It has been our custom for the last six years to cover tops and ends of stringers and caps in pile trestles, and tops and ends of stringers, caps and sills on frame trestles with carbolineum avenarius, applying it the same as we would paint. If the weather is cold we heat it in an iron vessel to about 150 degrees before applying same, but in the summer we do not heat it before applying. We do not use any roofing material or sheet metal for protection of the timber. From our experience with the use of carbolineum avenarius, I do not hesitate in saying that it fully repays us for the cost of the application. The first place where we tried it 10 years ago was as a covering on a plank floor for the paving of an overhead bridge. While this particular bridge has not been under our supervision for the last two years, it was inspected by us two years ago, and at that time the planking was in good condition, while at other places where we have used white cedar planking for the same service, the cedar has, after seven years' service, so badly decayed that it had to be removed.

3. We do not enclose piles or posts with casing near ground line or near the water to preserve same, but where frame bents are set so that they are covered partly by embankment, they are given a good coat of carbolineum avenarius before the filling is done around same.

4. We place at each end of our wooden trestles water barrels buried in the ground. These are at all times kept filled by the section men.

5. We have one wooden bridge with solid timber floor covered with ballast. I enclose a print of same. The timber is in good condition as yet. (See plan of wooden ballast floor bridge. M. C. R. R.)



End View.

Coat Top of Floor, Top, Ends and Bearing Surfaces of Stringers and of End Walls with Carbolineum.

Michigan Central R.R. Wooden Ballast Floor Bridge

Fig. 36.—Wooden Ballast Floor Bridge, Michigan Central R. R.

6. With the present price of timber, I do not believe it good policy to put in solid floor or wooden trestles covered with ballast, as I think that the cost of maintenance will outweigh the extra first cost of putting in a steel or concrete bridge.

7. Our timber trestles are given three regular inspections during the year. Early in the spring they are inspected by the foreman in charge of repairs on the division. In the middle of the summer they are given a thorough inspection by our regular bridge inspector. He then gives recommendations for the repairs necessary for the following year, and in the fall are inspected by the bridge engineer, accompanied by the regular inspector and the foreman of the division, and the work for the following year is laid out. Outside of this, the bridge foreman looks over the bridges in the winter whenever he has any spare time.

F. Ingram, Supervisor, Bridges and Buildings, Louisville & Nashville Railroad Company:

1. Our company has used creosoted pine piles and creosoted floors with ballast decks since 1876 on Southern Divisions.

2. Have used No. 20 B. G. galvanized iron as a covering on stringers of pile trestles for 14 years. Also to cover trestle caps. It prolongs the life of stringers and caps and is a great protection against fire. We also mop all bearings of ties, stringers, bolsters, as well as top and ends of stringers before placing galvanized iron on same and mop sides of stringers and top of ties and guard plank with hot creosote the second summer after they are put in place. (See plans of open floor trestles, Louisville & Nashville Railroad.)

3. On Southern Divisions where exposed to teredo in salt water, creosoted piles are used. Our company as a rule does not use any casing to protect piling, but may do so in some special cases. The best protection, from my observation, is well-treated timber.

4. Instructions are issued to superintendent to keep all dry grass, underbrush and other inflammable material cleared six feet from bents.

5. There are about 3,553 lineal feet of pile trestle with creosoted floors and ballast decks on the Memphis Division. (See plans of ballasted floor trestles, Louisville & Nashville Railroad.)

6. The cost of maintenance is very small. The items are inspection, grassing and renewing track ties under rails. Where creosoted piles or masonry for short openings are used, the cost will be trifling for probably 20 years, or longer.

7. Timber trestles and all structures are inspected monthly by bridge foreman and quarterly by bridge supervisors and semi-annually by the bridge engineer. Our method is by sight, sound and boring with a small bit the timbers which do not sound right and have hidden defects. We also use a 5-pound hammer to sound timbers, also an 8-square steel bar with a 3-inch ball on one end and sharp point on the other. It is 6 feet long and used to prod in places that seem to be unsound and cannot otherwise

be reached, when practicable. We also make examinations under passing trains and find it a very accurate method of locating weak stringers or settling piles, but do not place much stress on this method for inspection of bolsters or caps on pile bents. We also find it safer to have regular men do this class of work, and pick those men, as some are closer observers and quicker to detect or see defects than others. They also have better memory and recall results of last previous inspections made.

J. E. Johnson, Supervisor of Bridges and Buildings, Rutland Rail road Company:

1. No. Not building any except iron.

2. See question No. 1.

3. In the West I used tar, cement, whitewash and salt, sheet iron and gravel. Found in Illinois, where soil dries deep, the best treatment was to excavate trenches at bents three feet deep and fill with gravel, then lay sewer pipe and drain to creek. This method preserves piles longest of any, and worms did not attack piling. With lime and salt, tar, etc., dry rot would set in. My opinion of pile treatment is that in order to get results satisfactorily, all outside applications like paints, tar, etc., are useless, but that timber treated under pressure before putting in structure is the sure method of preserving piling.

4. We covered caps and stringers with No. 24 galvanized iron, each stringer covered independent except over caps.

5. None.

6. My opinion is that solid floor trestles with solid floor made of wood treated before placed, will outlast iron or steel plate, and if properly placed will cause little trouble for maintenance.

7. Timber trestles in good condition, once each year. Those decaying as often as is found necessary. Inspection should be made by excavating around each pile at ground to determine condition of piling and when necessary, cap, stringer, etc., for depth of rot. Note any cross-grain caps and stringers and make record of same, and such inspection should be made as frequently as the conditions warrant, to prevent failure until repairs are made. In noting the method of plating stringers see Canadian Pacific plan, which I think typical.

J. S. Lemond, Roadmaster, Southern Railway:

1. We do not treat trestle timber with preservatives, but we are considering the advisableness of doing so.

2. It is not our practice to cover tops of stringers and caps with any liquid preparation, roofing material, or other covering.

3. We do not encase piles or posts with any kind of covering.

4. We keep all inflammable material cleaned away from the trestles, and keep barrels filled with water near at hand.

5. We have no structures of this character.

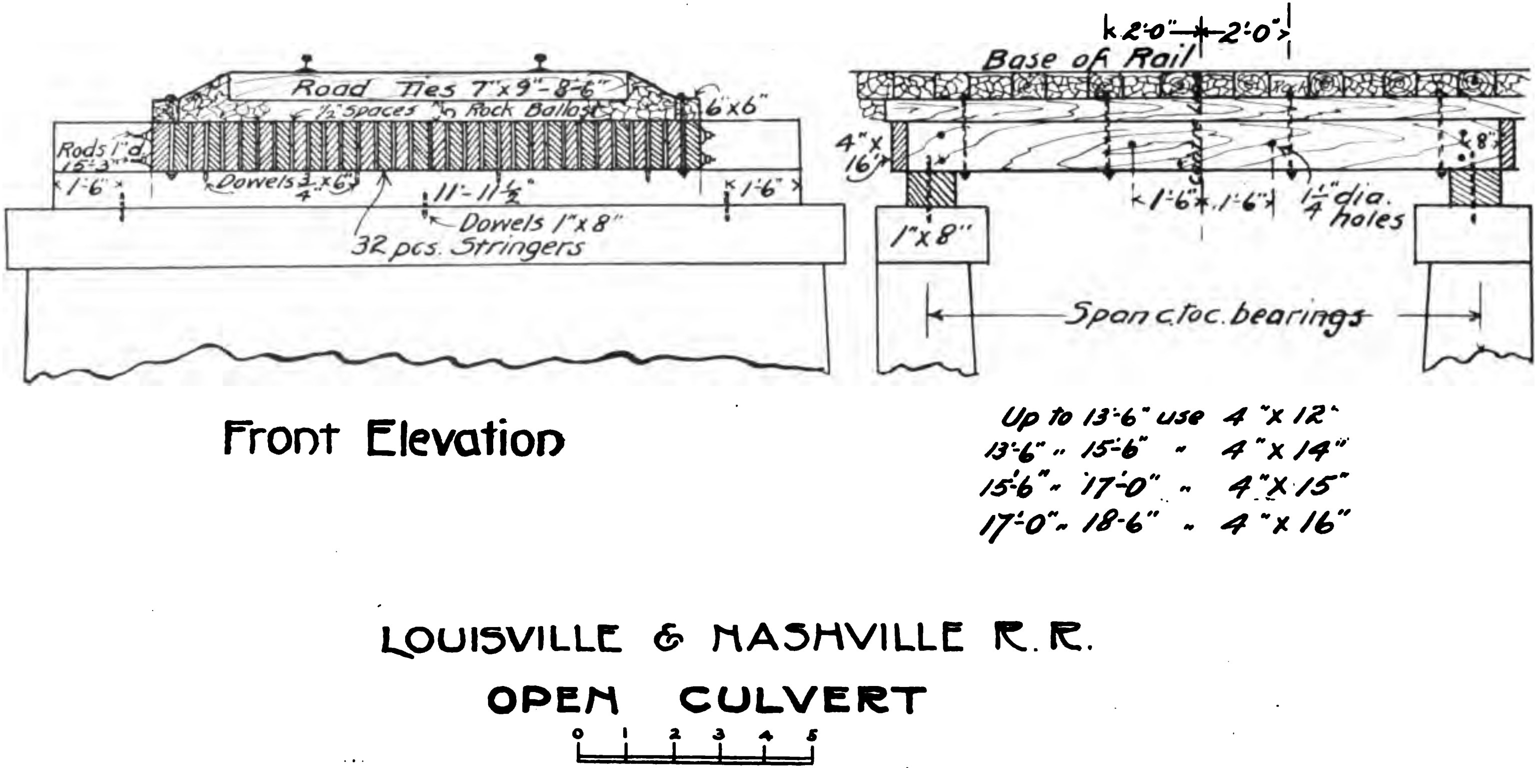
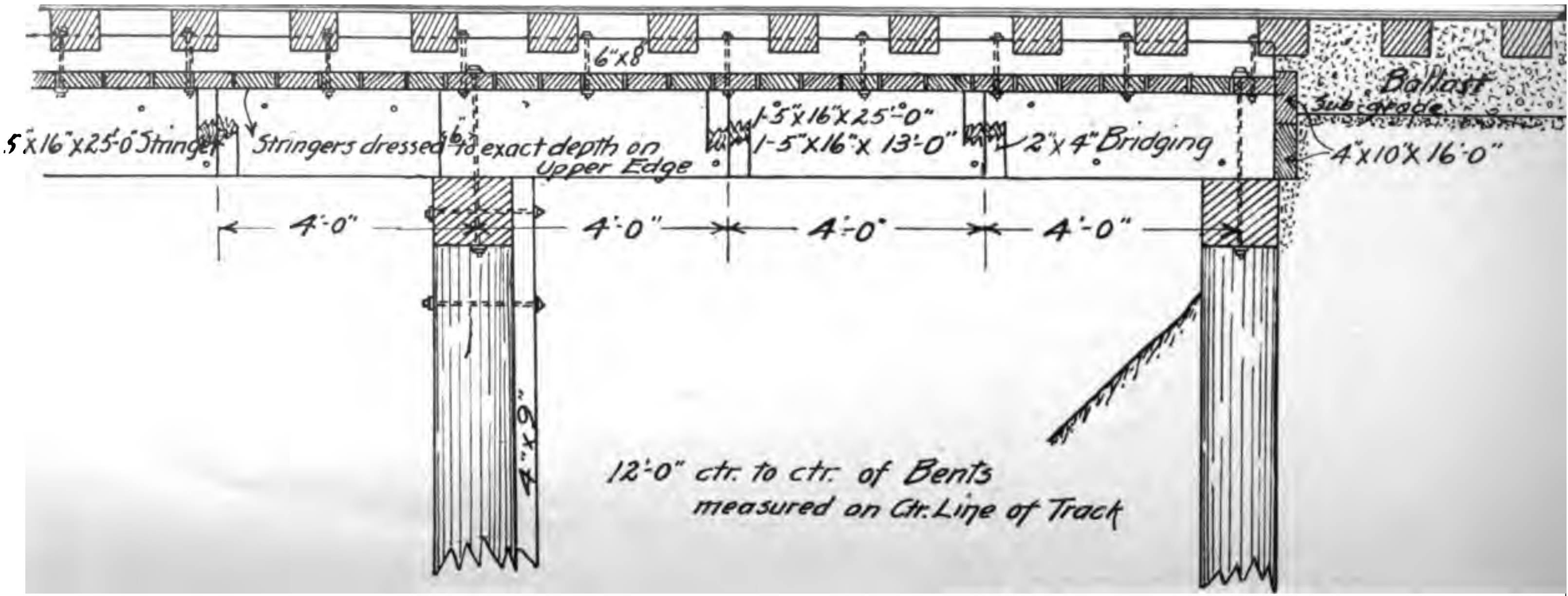
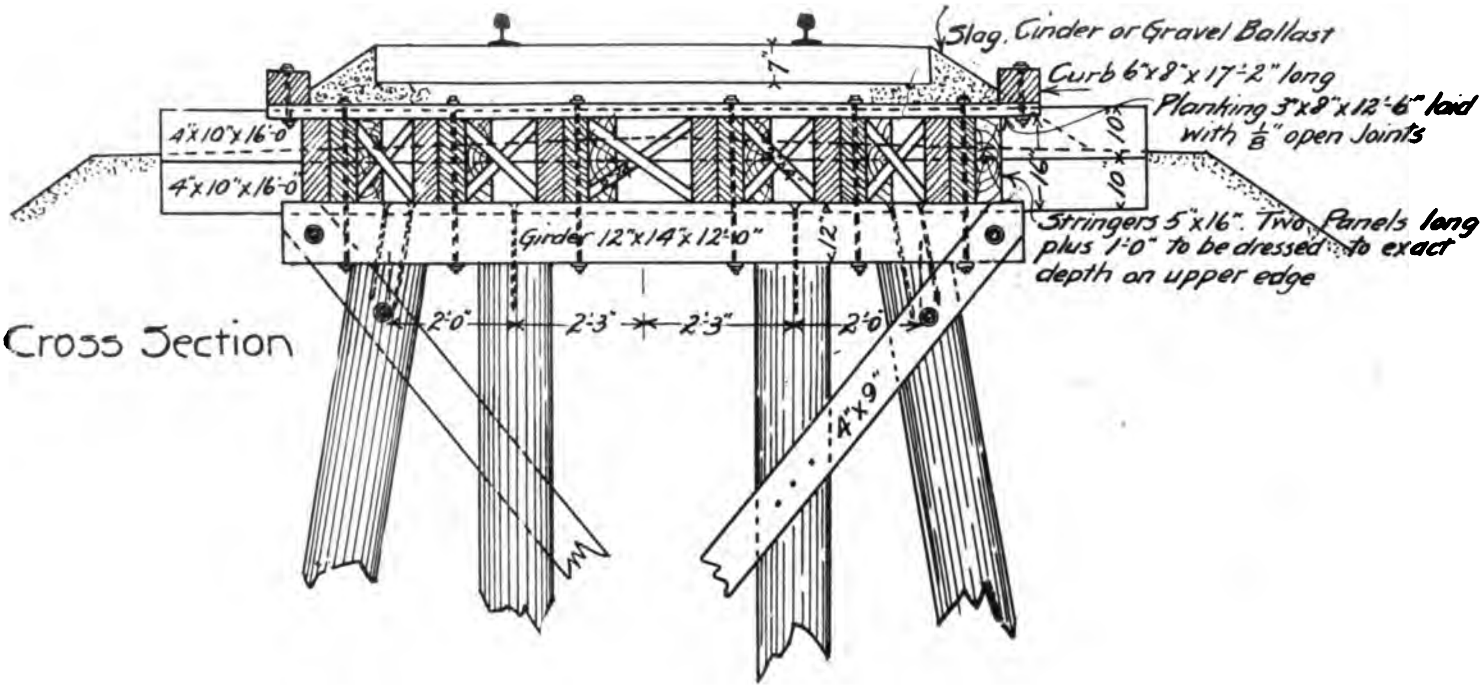


FIG. 37.—Open Culvert, Louisville and Nashville R. R.



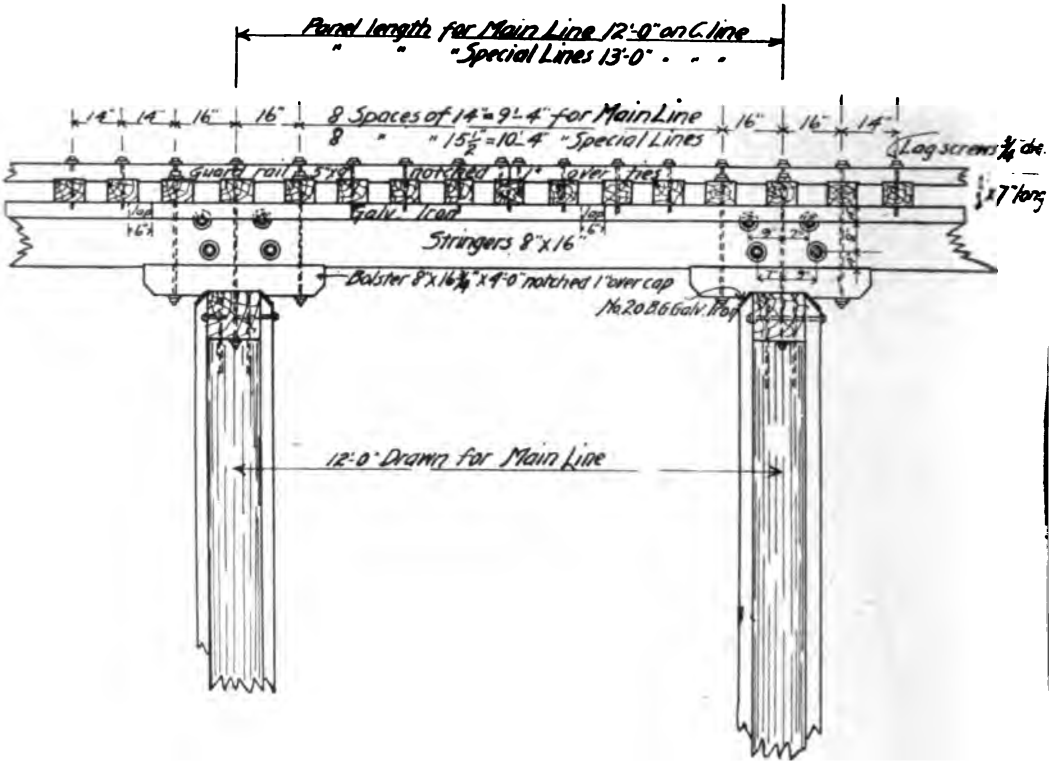
Longitudinal Section
on Centre Line

FIG. 88.—Pile Trestle, Louisville & Nashville R. R.



LOUISVILLE & NASHVILLE R. R.
Standard Plan for
Pile Trestle with Creosoted Floor and Ballast

FIG. 89.—Pile Trestle, Louisville & Nashville R. R.



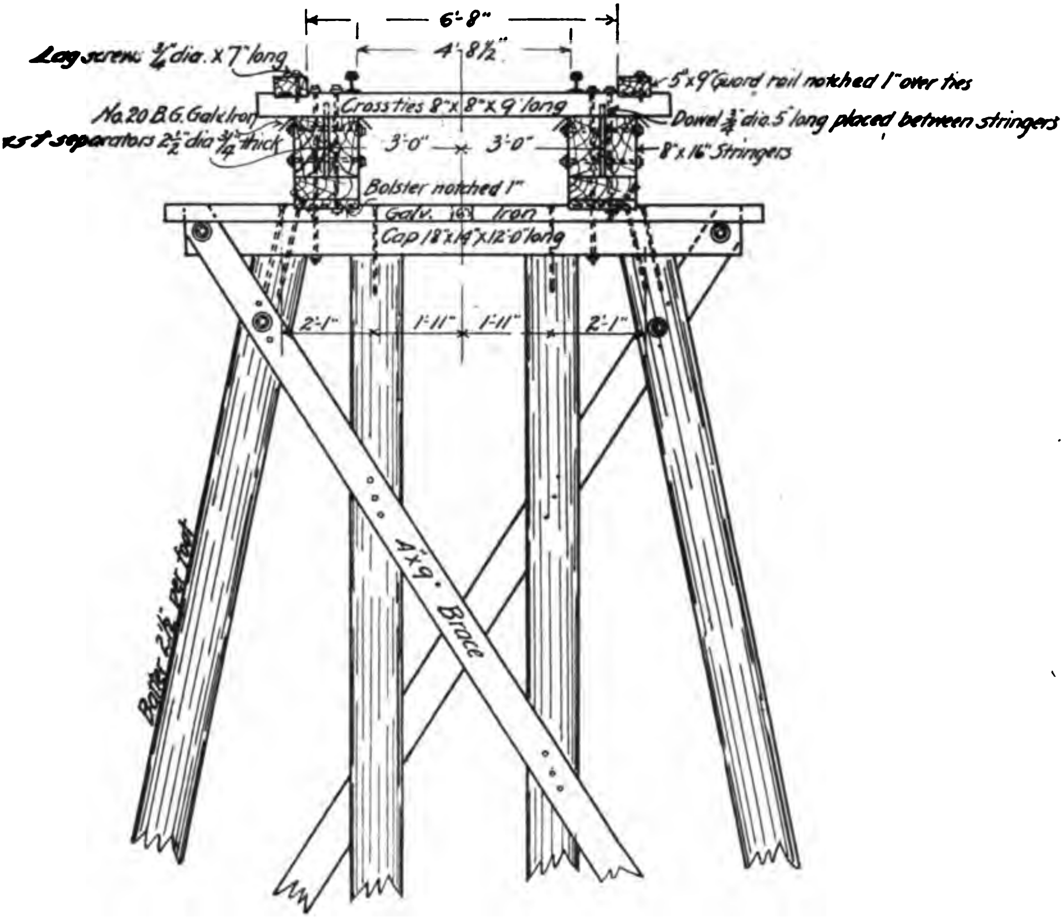
ELEVATION

All piles to be straight and not less than 10" at small end. Where cedar piles are used they must be peeled clean of all bark and painted with creosote oil 3 ft. above the ground and 2 ft. below.

Mop the inside face and tops of stringers before putting on the galvanized iron.

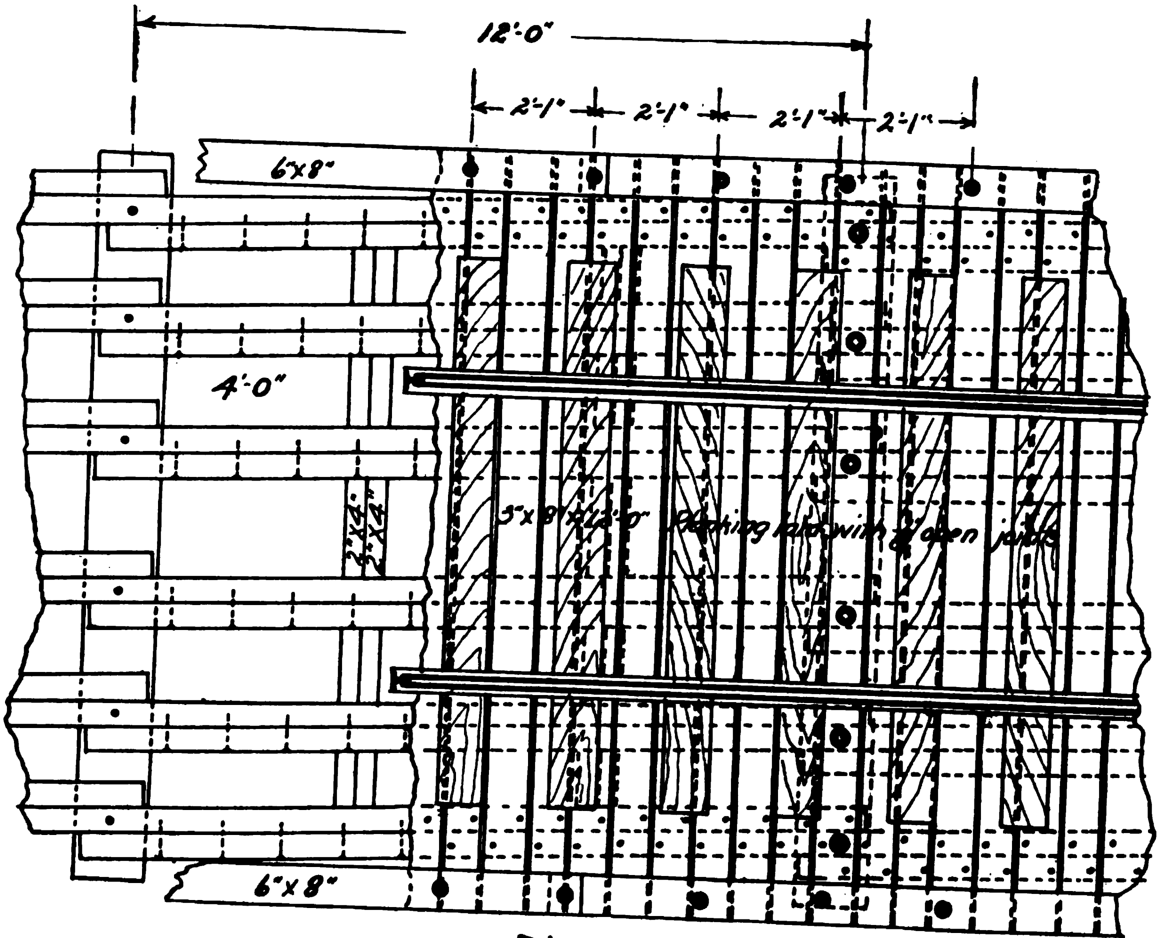
Tops of caps and all other inaccessible surfaces to be mopped with creosote oil at the time of placing the timber. The cross ties, guard rails, bolsters, cross bracing and bottom of piles 3 ft. above and 2 ft. below the ground to be mopped with the creosote oil after the following summer so that the timber will have a good chance to season.

Fig. 40.—Louisville & Nashville R. R. Standard Trestle—Open Floor



LOUISVILLE & NASHVILLE R.R.
STANDARD PLAN FOR PILE TRESTLE WITH OPEN FLOOR.

FIG. 41.—Pile Trestle, Louisville & Nashville R. R.



Plan

FIG. 42.- Plan, Standard Pile Trestle, Louisville & Nashville R. R.

6. Cannot give my opinion, as we have no structures of this character.

7. Our timber trestles are inspected every two months. This is in the nature of a general inspection. We have other inspections by the track supervisors and section foremen in a casual way as they pass over the line. Our method of inspection is to use a pick or a sharp pointed bar, and sometimes we use an auger.

A. E. Killam, Inspector of Bridges and Buildings, Intercolonial Railway of Canada:

1. We have not any trestle bridges.

2. We have but two pile bridges; one 400 feet long has creosoted Southern pine caps and stringers, but no other protection is used. Another 1,300 feet long has creosoted Southern pine double stringers, but the caps, which are Southern pine also, have no preservative.

3. No casing is used.

4. All short bridges have oil casks sunk at the ends of the bridges which are kept full of water during warm weather and emptied in cold weather. The long spans (75 feet and upwards) have water casks at both ends, and for two spans and more, a cask on each span to use in case of fire in deck.

5. We have no trestles covered with solid timber and ballast, but we have a cedar crib bridge 260 feet long, 28 feet, 6 inches high, covered with round cedar poles 6 inches top end, laid close, with cracks covered with soft wood brush between the curbs. This is also covered 18 inches deep with ballast. It has been built some fifteen years and is as good as new.

6. Answered under above.

7. All structures, wood, stone and iron, are inspected once a year minutely in every section by the general inspector and once a week or oftener by the section foreman. At all times where there is any doubt as to the stability of the material in any section of the structure, it is renewed so as to insure perfect safety.

D. W. Lum, Chief Engineer, Maintenance of Way and Structures, Southern Railway Company:

1. The matter is being seriously considered, but no steps have yet been taken to erect a plant.

2. No.

3. No.

4. No special treatment.

5. No.

6. Believe a solid floor covered with ballast is a very satisfactory structure, if the timbers are treated fully with creosote.

7. Timber trestles have continual inspection by track supervisor and section men and regular inspection by bridge supervisor every two months, reports being made of the condition.

William A. Lydston, Supervisor of Bridges and Buildings, Boston & Maine Railroad:

1. We are not using any preservative for trestle timber on this division. At present I do not know of any plans for future treatment.

2. We do not cover the tops of stringers or caps with anything, either liquid or metal, to prevent decay.

3. I never have enclosed piles or posts with casing, near the ground line, or in water, to preserve same.

4. Our bridges are supplied with casks, filled with water, and a pail in each, to use in case the trestle gets on fire. Through the cold part of the year salt is used in water to prevent freezing.

5. We have no such trestles as here described.

6. I cannot see any great merit in a trestle of the above description.

7. We inspect all our bridges twice a year. Our mode of inspection, to look over all parts in sight. As piles often look all right on outside but are rotten inside, we bore with a small auger into pile. This will show their condition.

W. B. McKenzie, Chief Engineer, Intercolonial Railway of Canada:

1 and 2. We brush carbolineum avenarius on bridge ties, but not on other parts of trestles or bridges; it is O. K.

3. We treat piles with creosote, and steel posts in water with concrete casing.

4. Barrels of water.

5. No.

6. Solid floor trestles covered with ballast are O. K., but the solid floor should have 10 pounds of creosote per cubic foot.

7. We have very few trestles on our line; but what we have are looked after by the track foremen, and our bridge inspector sees them at least twice a year.

A. W. Merrick, Assistant Engineer, Chicago & Northwestern Railway Company:

1. We do not at present. Do not know of any plans for treating bridge timber on this railway.

2. Some experiments in this line have been made at a few bridges on different parts of this division. For instance, we chose, for the purpose of comparison of efficiency of methods, a six-span pile bridge. The timbers of the first two spans were painted with a liquid asphalt preparation; the next two spans

with a creosote preparation and the last two spans were left unpainted. The method of painting, in each case, was the same, as follows:

All contacts of wood are painted. Surfaces of guard timbers where they bear on ties, and surfaces of ties where they come in contact with guard timbers. Surfaces of stringers where they come in contact with ties. At the points where surfaces of stringers and surfaces of caps are in contact. Surfaces of caps where they bear on piles and tops of piles where they come in contact with caps. Surfaces of piles for one foot above and one foot below point entering ground. This work was done in the fall of 1903. The value of either method in preserving the timber cannot be yet determined.

3. We are not troubled in this locality with attacks from insects in water.

4. We provide water barrels at ends of pile bridges. Bridges of one to three spans to have one barrel, four to 10 spans, two barrels and long bridges to have one barrel every tenth span.

5. No.

6. Never having inspected any solid floor trestles, I have no opinion to offer.

7. See proceedings of the Thirteenth Convention, pages 232 and 237. Replies of Messrs. Carter, Lichty, Riney, Kelley and Merrick.

Robert McKibbon, Master Carpenter, Pennsylvania Railroad Company:

In reference to your circular letter of June 8, I am very sorry to state that I will be of very little service in aiding towards the discussion of treatment of trestle timber, as this is something we do not carry out on our division. This is due entirely to the fact that we have very little trestle work which is subject to the destroying insect. You are aware that Pennsylvania is so full of sulphuric acid that it practically destroys insect life.

I might state that the greater portion of our bridges are iron and steel, concrete, stone and brick arches. We have, however, a few trestles which we use as coaling stations of which our foremen make a monthly examination, and I make a personal examination every four months myself, the examinations consist of boring, etc.

When we have trestles that need fire protection, and if they are within the city limits where water service can be obtained, we run a line along them, but where our trestles are in the country, where no water lines are accessible, we have water barrels which are always kept full and two pints of salt added to each bucket of water. Buckets are also kept in addition to the barrels. We have no trestles covered with a solid timber floor and covered with ballast.

D. L. McKee, Pittsburg & Lake Erie Railroad:

1. Not now treating or planning to treat with a preservative.

2. It is not our practice to take any precaution to protect tim-

ber from rotting as designated by this question. Do not think that the life of pile or frame trestles in our section would be increased by an application of liquid preparation and the covering up by other material would greatly increase the possibility of decay by retaining the dampness therein, and retard the free circulation of air.

3. Do not have any pile trestles to contend with at present. Some years ago we had considerable piling along the Monongahela and Ohio rivers, composed of all kinds of timber, but were not troubled with insects.

4. The only protection we use is barrels filled with water placed at convenient places for protection to timber trestles from fire.

5. Have no trestles of this character on our road.

6. Have had no experience in trestles designated by this question, but I think that the cost of maintenance would be very expensive for the same reasons that apply to answer of question No. 2.

7. The trestles owned by the railroad company and those operated jointly by other roads and those of individuals, are inspected quite frequently, notes taken of all defects and reported to the superintendent of bridges and buildings for future and further action.

Arthur Montzheimer, Chief Engineer, Elgin, Joliet & Eastern Railway Company:

1. No.

2. No.

3. No.

4. We put up water barrels and keep rubbish and grass cleared away from around our timber bridges.

5. No.

6. Have had no experience.

7. We inspect our bridges and culverts semi-annually. The fall inspection is made in September and is for the purpose of deciding on the bridge work for the coming year. The spring inspection is made as a precautionary measure to see that all bridges and culverts are safe and have not been affected by the spring freshets.

H. P. Morrill, Foreman of Bridges and Buildings, Chicago & Northwestern Railway Company:

1. I never had any experience in treating timber. We have used a very few pieces this season, the first on my sub-division.

3. We used No. 12 sheet iron for covering bridges during the years 1897 and 1898. I believe the stringers will last nearly twice as long if covered. We used 8-foot lengths and had them wide enough to run down 1½ inches on each side.

5. During the construction of a portion of the road in 1871 and 1872 on which I worked, we put a 3-inch plank covering on top of the stringers, which also answered for ties. The plank were 12 feet long and we used 8-inch by 10-inch guard rail. After the track was laid they covered the deck all over with three inches of gravel. This was done on all trestles and Howe truss bridges. The result was that in about three years the plank were so badly decayed that they would not hold the track, and the Howe truss bridges were so heavily loaded that they began to get out of shape. Castings were broken and braces crippled. We removed the old gravel and planking as fast as possible from one end of the road to the other in order to save the bridges. Do not cover any bridges in that manner now.

A. Munster, Chief Engineer, Chicago Great Western Railway:

1. No

2. No.

3. No.

4. I send you here a blueprint, showing our standard floor on pile and trestle bridges. The screened gravel gives us, I think, complete protection from fire, caused by cinders from the engines, but does not, of course, protect from fire attacking the structure from underneath. (See C. G. W. Ry.'s standard plan of fire-proof deck for pile bridges.)

5. No.

6. As per answer to No. 5, we have no solid timber floors covered with ballast on our road, and I have had no experience with their maintenance. It appears to me, however, that this construction prohibits, except at large cost, the proper inspection and repair of a very important part of the structure.

7. Our timber bridges are inspected every month by the division bridge supervisor, and once every fall by the division engineer.

W. S. McKeel, Master Carpenter, Grand Rapids & Indiana Railway Company:

1. We have been treating some of our bridge timbers in this manner, but not in all cases.

2. We do not cover caps and stringers.

3. We do not enclose piles or posts to preserve them from insects; have not yet been bothered by them.

5. We have pile trestles in use with solid timber, floors being covered with ballast, using Eastern Granite Roofing instead of tar paper, as shown in enclosed blueprint. We have one of the above bridges which was built in 1894 and I find timber in good condition. I am of the opinion that the ballast floor is much more safe, makes a better road bed, but when the time comes to repair it, it will be very expensive; much more than the ordinary open bridge. But of the two I would recommend ballast floor.

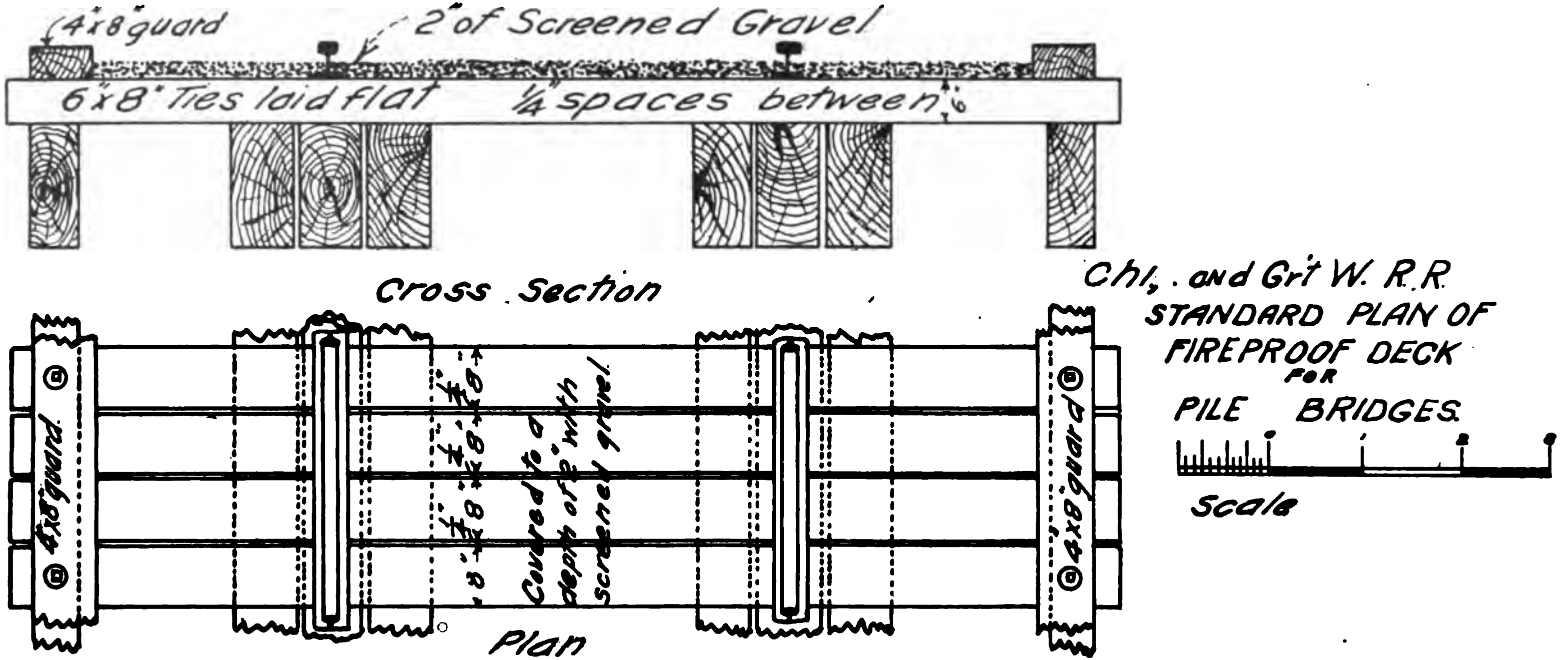


FIG. 48.—Standard Fireproof Deck Pile Bridge, C. & G. W. R. R.

7. We have annual inspection, and I inspect our bridges every three months, accompanied by bridge foreman and men.

I enclose a blueprint of our ballast floor. (See plan of ballast floor pile bridge G. R. & I. Ry.)

B. J. Mustain, General Foreman of Bridges and Buildings, El Paso & Southwestern System:

1. We have been using "Well-house" treatment; in fact, it has been used for about four years up to last July, but finding that it does not give the satisfaction desired, we changed to the creosote process, which we have found far more satisfactory.

2. We do not cover the tops of caps and stringers with any kind of liquid or tin. We place 1-inch by 6-inch pieces between ties and use gravel on top of same. I consider this quite an advantage considering the cost and saving from fire. The ties will not last as long, but it preserves chords and caps to a great extent.

3. We do not encase any of our piling at ground line.

4. As stated in No. 2, we cover all of our tie and timber bridges with gravel, filling in between the ties with 1-inch by 6-inch and 2-inch by 4-inch blocks on the chords for supports. This proves very satisfactory.

5. We have some solid timber floored bridges. Under separate cover am sending you plan. However, we have changed from this plan to one with 10 chords and 3-inch by 12-inch floor, which so far seems to be more satisfactory. (See plan of ballast deck bridges El Paso & Southwestern System.)

6. I think the solid floor much better than the open floor, as it has the advantage of more evenly equalizing the weight. As track is held in line by the ballast and surfaced to a great extent by the same, it also saves the expense of sending B. & B. men over the line, sometimes a distance of 200 miles, to line and surface, for this can be done by section men. Besides this, we figure the life of a ballast deck bridge from 12 to 15 years against 5 to 8 years for open deck bridges. The expense of putting it in is some greater, but the cost of maintenance is less. I think the creosote timber is far better than the "Well-house" or "Burnettized" for bridges of this kind; in fact, I think it is the best process of treatment I have ever seen used.

7. We have our bridges thoroughly inspected twice a year, with a monthly inspection of any that are not in the best of condition. We have holes dug around piling three to four feet in the ground for examining same, using a small steel bar for testing and augers on other timbers wherever they show signs of decay. As I have blueprints of these bridges, will send them to you. They will give you a better idea of them than I am able to do.

O. T. Nelson, Roadmaster, Atlanta & West Point Railroad Company and Western Railway of Alabama:

1. No.

2. White lead or tar, excellent protection.

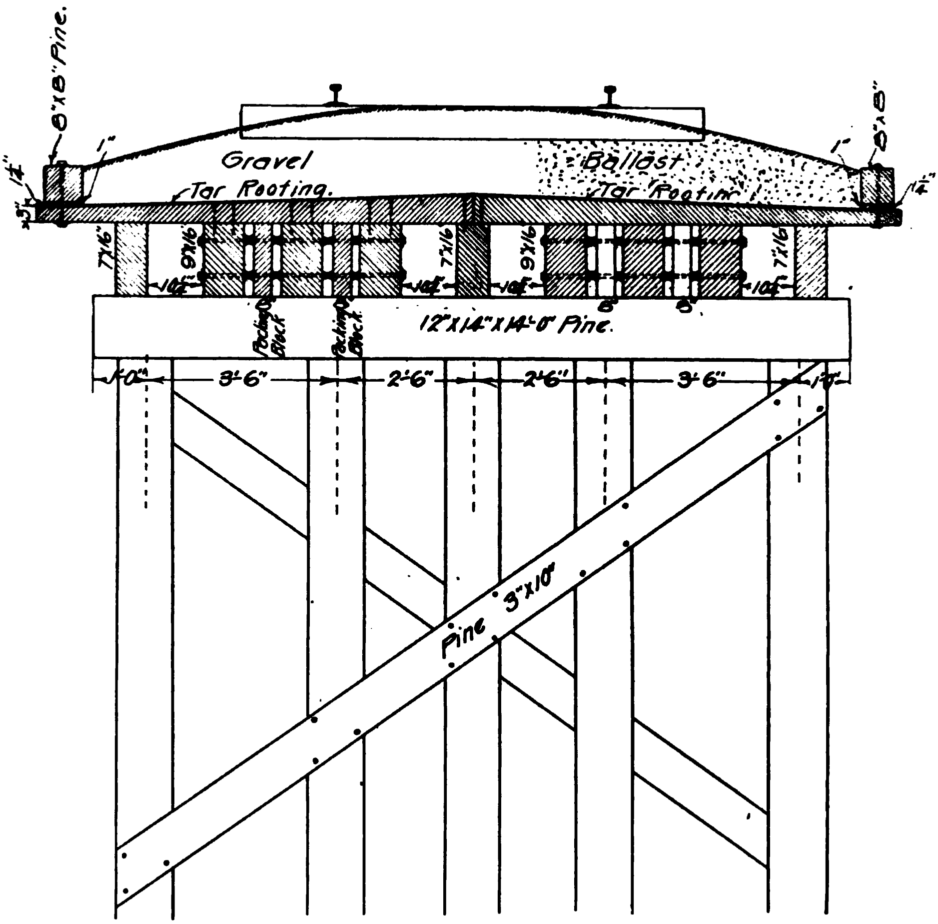


FIG. 44.—Grand Rapids & Indiana Ry.—Ballasted Pile Bridge.

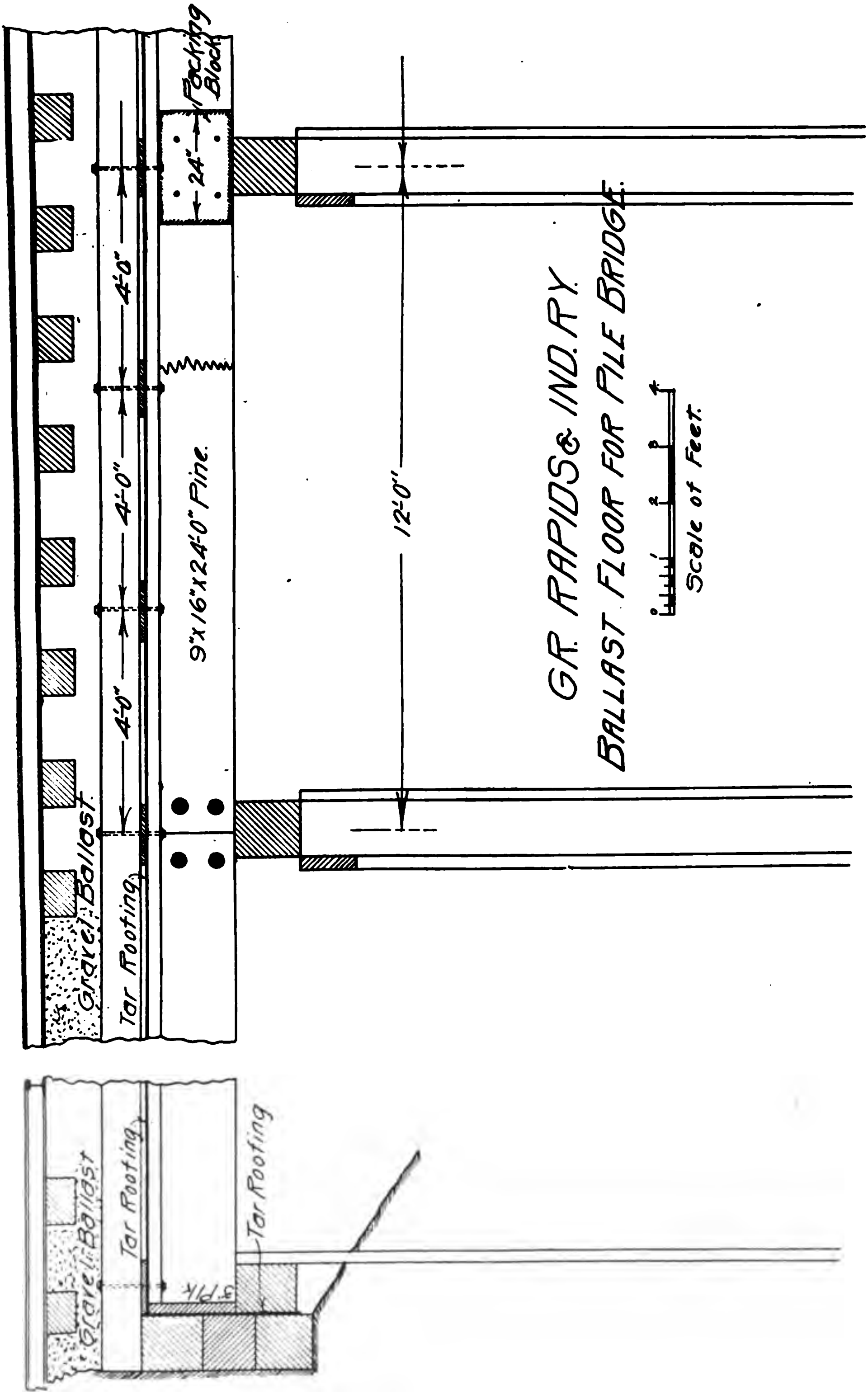


FIG. 45.—Ballast Floor for Pile Bridge, Grand Rapids & Ind. Ry.

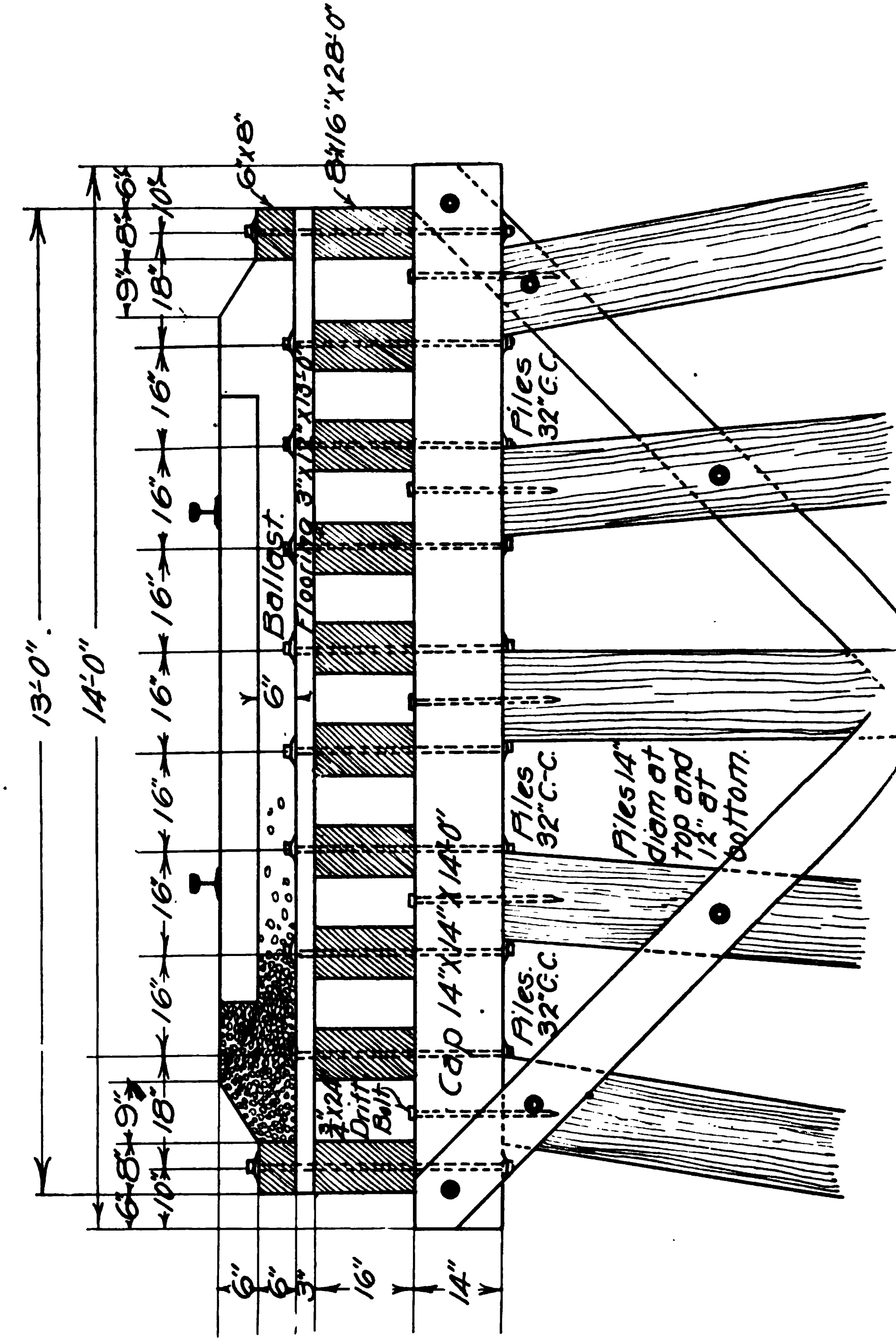


Fig. 48. Pile Ballasted Bridge, El Paso & South Western System.

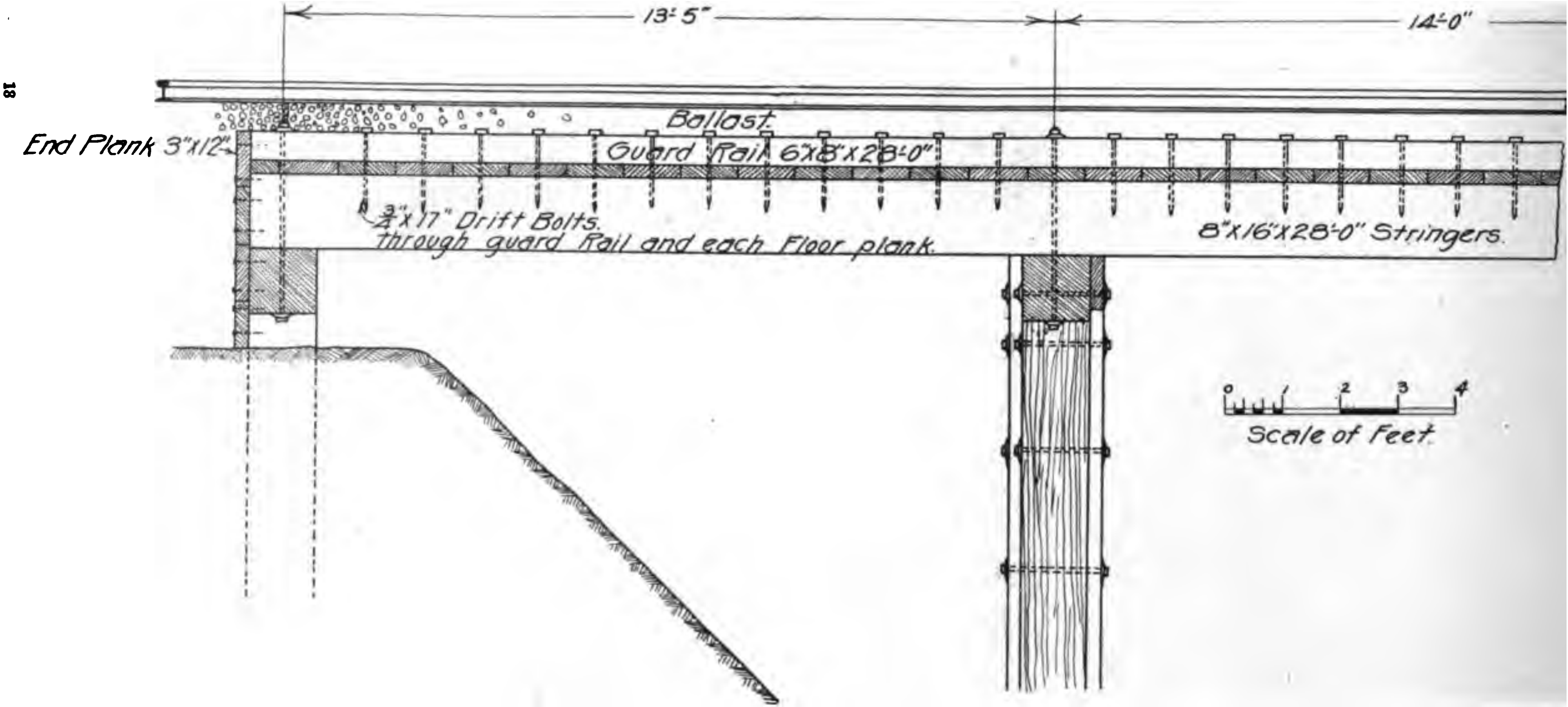


FIG. 47.—Pile Ballasted Bridge, El Paso & South Western System.

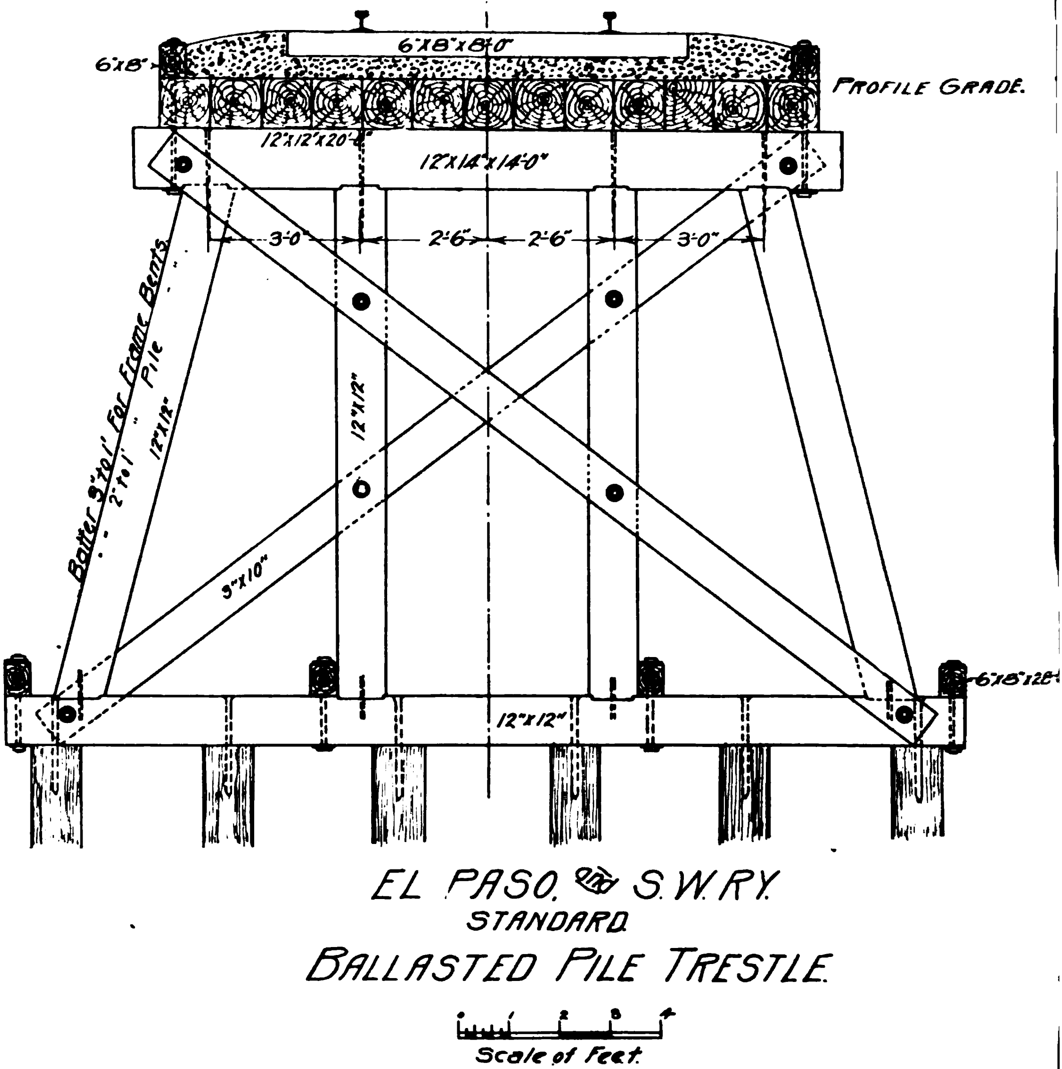


FIG. 48.—Ballasted Pile Trestle, El Paso & S. W. Ry.

3. We use tar on piles for two feet at ground line.

4. We use 2-inch by 6-inch timber between ties set in stringers in white lead or tar, sloped and punctured to drain, and fill to tops or rails with stone ballast. We use steel rails for guard rails on trestles.

5. None, except as outlined above under question No. 4.

6. We have no solid floor trestles on these lines.

7. We inspect once each week by section foreman and once each month by supervisor of bridges and buildings.

W. M. Noon, Superintendent of Bridges and Buildings, Duluth, South Shore & Atlantic Railway:

1. No.

2. Galvanized iron on track stringers only.

3. We are not obliged to. We have good water and soil.

4. Water barrels only.

5. We have none.

6. Do not approve of them.

7. Twice a year.

O. S. Osgood, Roadmaster, Portland & Rumford Falls Railway Company:

1. No.

2. No.

3. No.

4. Barrels established at stated intervals and kept filled with water, with pail for each barrel so located.

5. None.

6. No experience.

7. Depends somewhat on age. For first two or three years inspected once in three months. As they grow older they are inspected oftener.

In connection with the above subject I wish to state that the present time we have only one short pile trestle on our line. All bridges are of stone, steel or concrete.

We have one bridge floor in which there are 75,000 feet of hard pine timber laid in 1897. This floor has been kept painted on top and as far down on the sides of the ties as could be reached, say four inches. The results obtained in preserving this floor we consider justify the expense, as to all appearances the floor is good for several years yet.

F. L. Park, Master Carpenter, Chicago, Rock Island & Pacific Railway:

1. On some parts of the Rock Island system they are using creosoted pine piling. Other than that, no treated timber is used.

2. We do not cover tops of stringers or caps in open pile trestles with any preparation or metal covering.

3. We do not enclose piles or posts with any casing, to preserve same from insects. The only thing that has been used on this line is refuse salt upon piling at ground line. This proved very satisfactory as a preservative to oak piling.

4. We have all of our trestle bridges supplied with water barrels and pails. We locate one 50-gallon water barrel to every four bents. During the winter we have two pounds of salt to each gallon of water put in barrel to keep from freezing. Of course, in a colder climate it would require more salt.

5. We have no ballast deck bridges on my territory. In fact, it is only recently that the management has proposed using same.

6. From maintenance standpoint, I believe that ballast deck trestle bridges will prove to be very expensive to maintain, especially as timber gets old; from the fact that when it becomes necessary to renew the piling, condition of solid floor will be such that I believe it would be necessary to put in new timber to carry traffic and allow driving piles. Another thing I object to is, that it, being a solid floor, would leave no opening for inspection, and no good conclusion can be arrived at as to condition of timber without a great deal of expense in removing ballast to get at same.

7. We have our timber trestles inspected once a month by the division inspector, who reports directly to this office. Twice a year I make a close inspection myself in company with division inspector, and these inspections are what we base our requisitions for repairs and renewals on for the following year.

J. F. Parker, General Foreman, Atchison, Topeka & Santa Fé Railway:

1. We are at present using creosoted piling and timber in wooden trestles, but are planning to use creosoted material entirely in the future.

2. It has been our practice for several years to cover tops of stringers and caps, as well as ties, wood guard rails, sway braces, posts and sills in open pile and frame trestles with crude oil. Our standard plan, which has recently been gotten out for such trestles, provides for caps and chords to be covered with No. 26 galvanized iron, with water proof lock joints, the same to be turned down over edges two inches. The application of crude oil is very beneficial on untreated timber. It prevents checking to a large extend, and fills all existing checks, and prevents rotting from water standing in checks which open upwards. It adds to the good appearance of a bridge and we do not consider that it increases the danger of fire.

3. We do not enclose piles or posts with a casing near the ground line to preserve same from insects. We do, however, enclose piles in wharves, and also in a few bridges where salt water has access to them, with a concrete casing, to prevent their destruction by the limnoria. This is applied by using a sheet

iron casing large enough to allow two inches of concrete around the pile; the casing is filled and when the cement is set the iron casing is removed. This is a sure protection. We have tried a number of other methods, but they have not been a success.

4. On our principal bridges we place barrels to be kept filled with water, and provide buckets for handling same; also in dry weather keep the ground under trestles clean of dry grass and combustible stuff as a protection against fire.

5. We have bridges with solid floors covered with ballast, and am sending a complete plan of our standard. (See plan of A., T. & S. F. ballasted wooden trestle.)

6. My opinion of the ballasted deck bridge from a maintenance standpoint is that it is good. One of the bridges well put up with creosoted material should run 20 years with a little or no cost for repairs, and does not require any attention by bridge men.

7. On this division a regular bridge inspector is employed, who devotes nearly all his time to this work, and making light repairs with the assistance of one or two men. Once a year the general foreman and bridge inspector together make a general inspection of the whole division.

B. F. Pickering, General Foreman, Bridges and Buildings, Boston & Maine Railroad:

1. Not on this division.

2. It has been our practice for a year or two to cover the caps with sheet zinc, and from present appearances I think it is a good thing to do.

3. No.

4. Water barrels and pails placed at short distances apart on trestles.

5. No.

6. No chance to observe on this division.

7. Twice a year. Sounding with a hammer and trying the piles at the surface of the ground or water as the case may be, with a thin, sharp tool, to see at what depth the outside rot has penetrated, this being the point at which our trestles first give out.

R. H. Reid, Supervisor of Bridges, Lake Shore & Michigan Southern Railroad:

1. We are using carbolineum avenarius as a timber preservative on all of our important timber structures where the timber comes in contact with earth or other timber in such a way as to be liable to cause decay. We have not yet used it generally in construction of our ordinary pile trestle bridges.

2. We have in some cases covered the tops of stringers with sheet iron to prevent decay, but are not doing so generally at present.

3. We do not enclose piles or posts with any casing, as we have had practically no trouble from attacks of insects.

4. We have filled the spaces between the ties of some of our more important trestles with 2-inch pine making, with the ties, a solid floor, and have covered this with crushed stone to prevent fire caused by dropping of live coals, etc., from engines.

5. We have no trestles with solid timber floor covered with ballast.

6. As we have never built or maintained any ballast floor timber trestles, I cannot give any opinion on this which would be of any value.

7. Timber trestles are inspected twice a year by bridge inspectors, once a year on general inspection by supervisor of bridges and buildings, and once each month by roadmasters. In special cases and under special conditions some of the trestles are inspected very frequently.

H. Rettinghouse, Division Engineer, Wisconsin Central Railway:

1. We have not as yet treated any of our trestle timbers with preservatives.

2. We do not cover horizontal surfaces of bridge timbers with liquid preparation, sheet metal or roofing material.

3. We do not enclose piles or posts with casing near ground line, neither do we preserve timber or piling placed in water, as all of our docks are located in inland lakes where they are not subject to attack of insects.

4. We protect all of our bridges against fire by placing a liberal number of water barrels on bridges. The Ashland ore dock is protected by an elaborate automatic sprinkling system.

5. We have no trestles with solid timber floors covered with ballast, but we are proceeding to protect all our trestle pile bridges with a ballast floor, as per attached blueprint. (See plan of ballast floor pile and trestle bridges, Wisconsin Central Railway.)

6. Owing to a lack of experience in that direction, I am not in a position to give any opinion at this time as to the possible merits of solid floor trestles covered with ballast.

7. Timber trestles on this line are regularly inspected each fall and spring, with special inspection between these times where it is deemed necessary.

F. B. Sheetz, Engineer of Bridges and Buildings, Missouri Pacific Railway Company:

1. No.

2. No.

3. No.

4. For trestles less than 50 feet in length, one water barrel is placed in the ground in front of the bank bent at one end of the

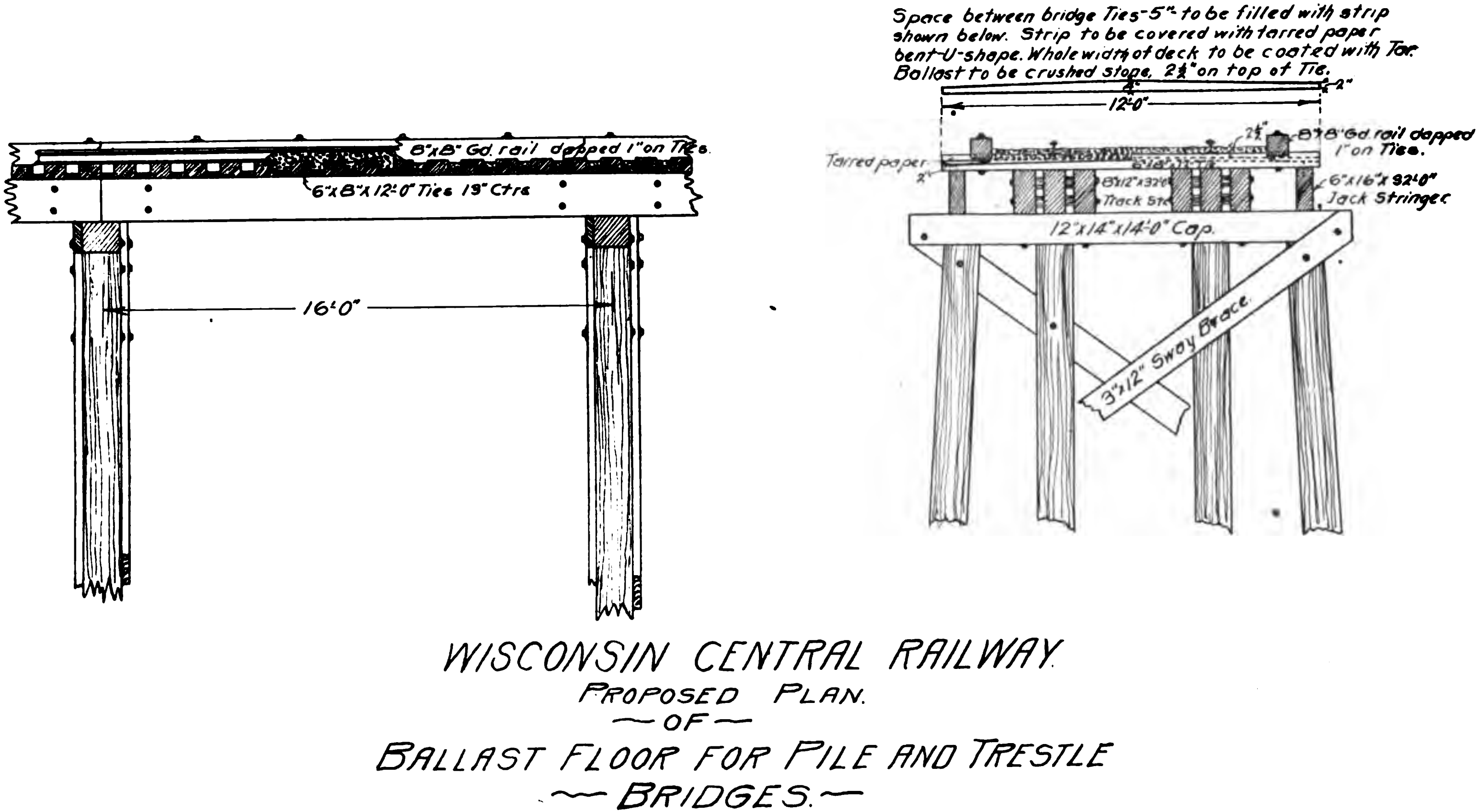


FIG. 49.—Proposed Plan of Ballast Floor for Pile and Trestle Bridges, Wisconsin Central Ry.

bridge. For trestles 50 to 150 feet in length one water barrel in the ground in front of bank bent each end of bridge. For trestles 150 feet and over, water barrels at ends of bridge and on top of cap, 150 feet apart. These barrels are kept full of water by the section men.

5. No.

6. We have no solid floor trestles covered with ballast on our system and have had no experience with them. However, I think they are worthy of consideration, and would be a great preventive of fire. We have notices almost daily of fires on open top trestles, and some of them are expensive ones.

7. Our timber trestles are inspected once a week by track foreman passing over the sections, reporting any defects to the supervisor of bridges and buildings. A competent bridge foreman inspects each bridge at least once a month and makes a detailed report of all defects to the supervisor of bridges and buildings. Every three months the supervisor of bridges and buildings personally examines each bridge and makes a report to the division engineer. Every six months the division engineer personally examines each bridge inspected by the supervisor of bridges and buildings and makes a report to the engineer of bridges and buildings. In the fall of each year an inspection is made by the engineer of bridges and buildings for the purpose of making program for all work that will be required for the coming year.

G. H. Soles, Superintendent, Bridges and Buildings, Pittsburgh & Lake Erie Railroad Company:

1. No.

2. No.

3. No.

4. The only protection we use is water barrels, placed about 150 feet apart, on trestles, and kept full of water to be used in case of fire.

5. No.

7. We only have about 500 lineal feet of trestle on our road, which is inspected once a month by the foreman of bridge gang, or one of his men, and any defects found are promptly reported to the superintendent of bridges and buildings.

A general inspection is made once a year of all bridges and trestles on the road; this is made by going over the road with an engine and car, the inspection party being made up as follows: Chief engineer, assistant chief engineer, assistant engineer and consulting bridge engineer and superintendent of bridges and buildings.

W. F. Steffens, Engineer of Bridges and Buildings, South & Western Railway Company:

The road with which I am now associated has tabooed trestle construction, as it is making instead fills, up to and including

135 feet in height, with the object of eliminating maintenance. Speaking in a general way, *ex officio*, I can comment as follows upon your questions.

1. It is undoubtedly economy to treat all trestle timbers with a preservative of some kind. The increased life will more than offset the slight additional expense due to the treatment.

2. The tops of stringers and caps in open trestles, and especially portions where two wooden surfaces are in contact, should be liberally treated with carbolineum avenarius, or dead oil, as it is these surfaces that decay most rapidly, due to the moisture settling thereon. By reference to my report on preservative methods read at the Convention of 1904, you will note that special stress was laid upon enumerating the three conditions necessary for decay, *i. e.*, air, moisture and warmth. Exposed horizontal surfaces supply all three of these conditions. The preservative acts not only as antiseptic, preventing the formation of the fungi, but also to close the external pores of the timber, and thus exclude both air and moisture.

3. The Pennsylvania Railroad at one time had a standard plan showing length of tile pipe surrounding the posts of trestles where in contact with the ground. If I remember correctly the pipe was filled with concrete in each case. The critical point of the trestle post is at the ground level. At this point the three conditions named above are to be found simultaneously. The use of tile pipe or other casing filled with concrete eliminates the two conditions of air and moisture.

4. The trestles should be amply provided with water barrels as protection against fire.

5. Solid ballasted floor for trestles, if the timbers are well creosoted, provides a cheap and efficient form of structure. The Louisville & Nashville Railroad has miles of trestles of this description in successful use.

6. Practically covered by No. 5.

7. Timber trestles should be thoroughly inspected at least quarterly, if in first-class condition. If in at all doubtful condition, almost daily inspection would be necessary.

B. J. Sweatt, Division Engineer, Chicago & North Western Railway Company:

1. The North Western does not treat trestle timber with a preservative and, as far as I know, no plans have been made to do so in the near future. The question has been discussed somewhat by the chief engineer and his assistants, but I do not think any definite plan has been decided on.

2. It is not, at the present time, our practice to cover the tops of stringers, or caps, in open pile and frame trestle bridges with any liquid preparation, roofing material or sheet metal in order to protect timber from rotting. A number of years ago we built a type of pile bridge and covered the two main stringers under each rail with sheet iron. This method was found to preserve the timber to a certain extent, but it is questionable whether or

not the practice would be advisable. In our present type of bridge, where we drive a line spike in each tie, the line spike would, of course, have to be driven through the sheet iron protection and admit more or less moisture to the stringers.

3. We do not enclose piles or posts with a casing near the ground line or in the water, to preserve them from the attack of insects.

4. In order to protect timber trestles from fire, the section men are required to cut the grass and weeds from under bridges and to see that all combustible material is removed from around piles or frame bents.

5. So far as I am aware, we have no solid timber floors covered with ballast.

6. In my opinion, a solid floor trestle properly constructed and covered with ballast would be an economical bridge from a maintenance standpoint, provided the pile and bridge timber be treated so as to prevent rapid decay. The saving in maintenance would be on account of the fact that section men would line and surface bridges instead of requiring a bridge crew especially for this work. It would also save the necessity of a bridge crew putting in shims during the winter months to take care of the action of the frost. The shimming could be done by the section men.

7. The timber trestles on the North Western are inspected by the foreman of bridges and buildings in the month of April and by the foreman of bridges and buildings and the division engineer sometime during the months of July, August and September. There are also, generally, one or two inspections made of all pile and trestle bridges by the general bridge inspector.

P. Swenson, Superintendent of Bridges and Buildings, Minneapolis, St. Paul & Sault Sainte Marie Railroad Company:

1. We do not treat trestle timber with preservative.

2. We cover tops of stringers over caps; also cover tops of caps with galvanized iron and find it to be very good. (See general plan of pile and trestle bridges, M., St. P. & S. Ste. M. Ry.)

3. We do not enclose piles or posts with casing near ground line.

4. We protect some of our timber trestle from fire by covering the top of the ties with crushed rock, pea size.

5. Please find blueprint showing top of trestle bridges covered with ballast; crushed rock, pea size, or broken stone. (See plan of ballasted floor of M., St. P. & S. Ste. M. Ry.)

6. Trestles covered with ballast are all right, as far as they go, for fire protection, but it shortens the life of the trestle.

7. I go over the road myself with a gasoline car and inspect all bridges, culverts and all buildings once a year, and sometimes twice. I have the bridge crews divided up in divisions. Each foreman has so many miles of road to look after, about 200 miles each, and has to inspect his division four times a year.

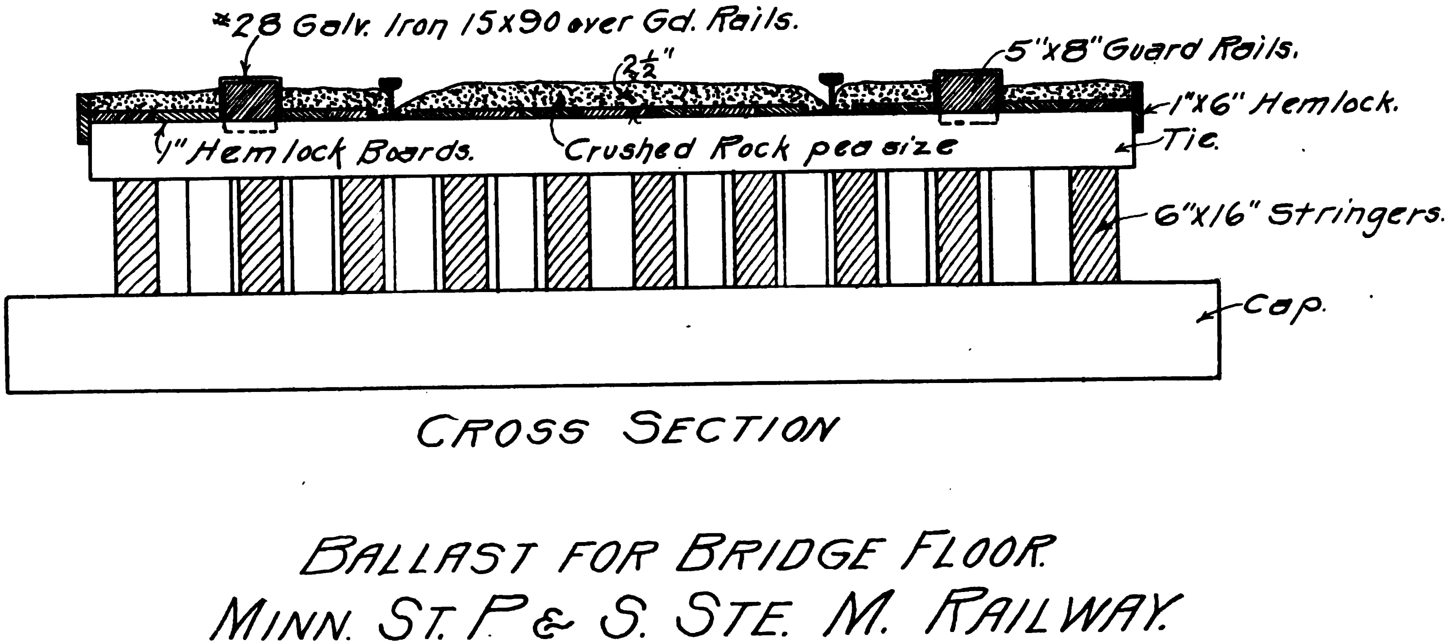


FIG. 50.—Ballast for Bridge Floor, Minn., St. P. & S. Ste. M. Ry.

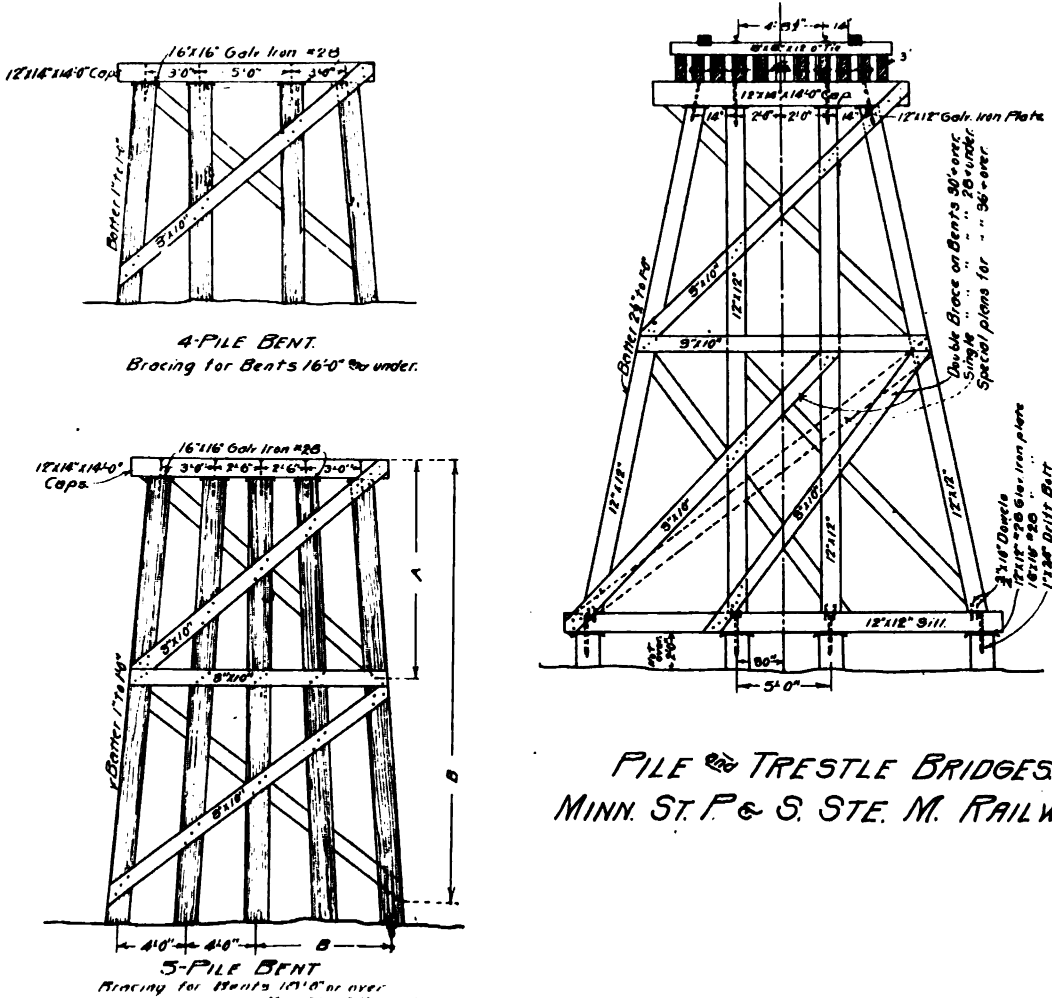


FIG. 51.—Pile and Trestle [illegible]

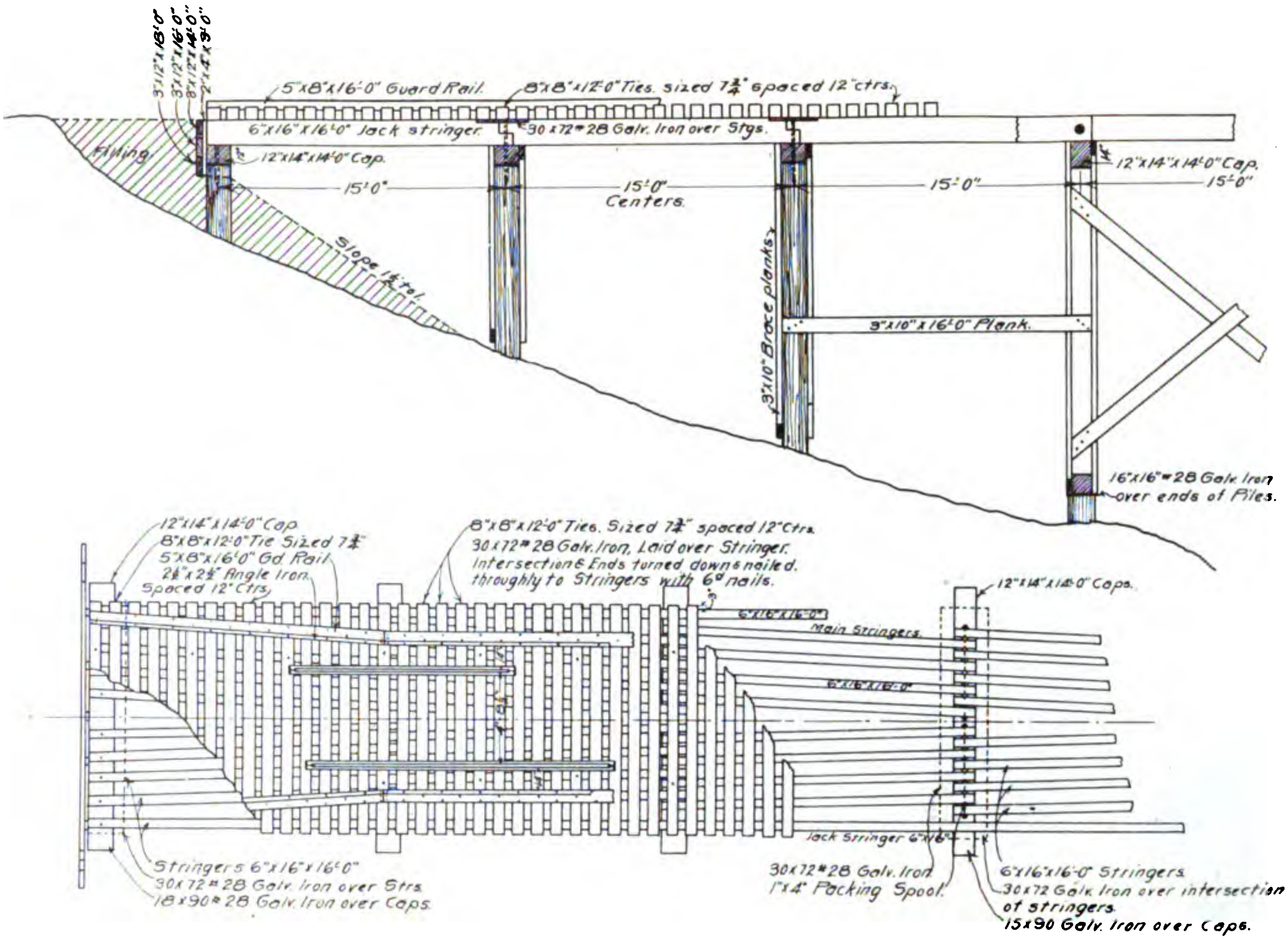


Fig. 52.—Pile and Trestle Bridges—Minn., St. P. & S. Ste. M. Ry.

J. O. Thorn, Master Carpenter, Chicago, Burlington & Quincy Railway:

1. Our company is planning to treat piles and trestle timbers with some preservative.

2. No.

3. No.

4. Yes, at present the old practice of placing barrels in the ground at each end of bridge of six bents. We place one or more barrels on caps according to the length of bridge. Of course we use salt in the barrels.

5. Not on my division. Solid timber floors have been tried on some parts of the line. Am told that they are not satisfactory and the practice is not being extended.

6. Answered under No. 5.

7. Twice annually it is our custom, accompanied by the division officers and foremen.
In regard to fire protection and preservative combined. I have experimented a little with salt for a period of 17 years and have had better results with it than with anything else I have ever tried. We have one pile bridge 800 feet long, 14 feet high, across an island in Rock River. The piles for this were driven in June, 1899, and are yet in serviceable condition. We are now using this treatment on three long trestle bridges with good indications. The bridges are only six years old, so the final result cannot be stated.

W. O. Waggoner, Supervisor of Bridges and Buildings, Illinois Central Railroad Company:

1. Our road is using creosoted material for bridge timber. This practice has been in use more than two years.

2. It has been our custom for a number of years to cover the tops of stringers and caps on open pile and frame trestles with 22-gauge galvanized iron. Also prior to the method of treating bridge timbers in the treating plant, I used a preparation of creosote, oil and tar, and applied same with a common, ordinary three-knot whitewash brush on all sides of timbers. This method was quite an advantage to the preservation of untreated material. I am at present using 22-gauge galvanized iron on top of stringers and caps in open pile trestles for a twofold purpose: First, to exclude the water; second, as a fire protection.

3. I have never used any casing to protect timbers from insects more than the application of creosote, oil and tar.

4. I use for fire protection on pile and timber trestles, water barrels on every fifth bent, with a wooden box bucket, having a common wire bale, placed in each barrel. Also use galvanized iron over the tops of stringers and caps on all untreated pile and frame trestles. On treated pile and frame trestles I used screened rock between the guard rails to catch all falling embers. This rock is supported in place by 2-inch by 6-inch timbers be-

tween each tie, laid on a 3-inch block, putting three inches of screened rock on top of the deck.

5. We have adopted as standard pile trestle the solid timber floor deck. This deck consists of 10 stringers, the two outside stringers being 12 feet apart. On top of these 10 stringers are 4-inch by 12-inch by 12-foot plank, laid closely together and spiked down to the stringers. On top of the 4-inch plank, over the outside stringers, is a 6-inch by 8-inch guard rail or ballast board, and between these timbers is placed six inches of crushel limestone rock. Then the track is laid on top of this same as on the dump.

6. I regard these trestles as the best that can be built, all material used being treated material from the treating plant, and the life of this material is from 25 to 30 years, which makes the life of the trestle about 25 years without expense.

7. It is my practice to have all timber trestles inspected once each month and a report made of their condition on a form provided for that purpose. I make personal inspection of all bridges three or four times yearly. I use for inspecting timber, a sharp, slim pointed instrument with a springy handle that can be thrown into sound timber 1½ to 2 inches deep and withdrawn without injury to the timber. If timber shows decay the instrument will penetrate much deeper with the same stroke.

I. O. Walker, Assistant Engineer, Nashville, Chattanooga & St. Louis Railway:

1. We do not treat any trestle timber, but buy a small amount of creosoted timber and piling in special cases. For example, pile piers under girders and trestles and creosoted end caps for our ordinary pile trestles.

2. We have been treating our stringers with avenarius carbolineum but have discontinued doing so, as we do not consider that the results will come anywhere near equaling the cost. We now cover our stringers with No. 22 galvanized iron.

Where we use two 8-inch by 16-inch stringers under the rail we use 34-inch iron. This iron is bought in such lengths that when folded together at the ends it brings the joints between the ties. We use 18-inch iron on caps 12 inches wide, and if we have double caps on account of raising the bridge for ballast, we use 24-inch iron on caps 12 inches wide.

The iron between the stringers is turned up on the side of the stringers to a point about 12 inches above the cap and is securely nailed. Outside of the stringers the iron is carried up in a similar manner, but in addition galvanized iron tags are riveted to the covering and these in turn nailed to the caps.

I am of the opinion that if we can get galvanized iron which will stand the weather, together with the dripping brine from refrigerator cars, that this method will prolong the life of the timber from 20 to 25 years.

3. We have no occasion to protect our piling from insects, as we do not come in contact with salt water.

4. Our stringers are 10 inches outside the rail, which makes it impossible for fire to lodge on them. The galvanized iron mentioned in question No. 2, is also a perfect protection against fire as far as the stringers and caps are concerned.

In addition to this we make it an invariable custom to cover the line once or twice a year and remove all bark, dry, rotten sap, slivers, or anything about the bridge that can catch fire. In this connection, would state that our piling is almost entirely red cedar and requires very careful attention to see that it does not catch fire.

5. We have no trestles with solid ballasted floors. We have however, on the system, perhaps, one half dozen deck girders with ballasted floor. There is nothing peculiar about these floors, they simply consist of 8-inch by 10-inch timbers laid across the girders with a gravel guard bolted to the ends.

6. My opinion about the ballasted floor is largely a matter of theory, although I have consulted with the Louisville & Nashville engineers, who have been using these floors since 1886. The merits are, almost absolute protection against fire, ease in maintaining line and surface of track. It also rids the bridge department of the endless work caused by the somewhat idiotic performances of the roadmasters in changing the elevation of their curves and raising their track at any and all times. With a ballasted deck, they can do as they wish at any time. In my opinion, the most serious demerit in the design of the ballasted floor trestle, is the expense of future repairs. Where these trestles have been built entirely of creosoted timber, framed before it was creosoted, the need of repairs is very slight, but many of our largest and busiest roads are using untreated timber and it seems to me that the matter of repairs will soon become a difficult problem to solve.

7. Speaking for this division alone, we have two routine inspections each year. Sometime in May I examine, with proper assistants, every bridge and culvert on the division and make copious notes as to their condition and the work I think ought to be done on them in the next 12 months. From these notes I dictate a statement of repairs, etc., which is typewritten on a 4¼-inch paper bound in books and one issued to each of the gangs on the division, so that no matter where a man drops off, he has only to open his work book and see what is to be done in that vicinity. On the spring inspection, every stick of timber in the bridges is carefully examined, and by using a mirror, every culvert is also examined for cracks in the pipes, etc. The larger brick and concrete culverts are examined by going through them.

In October I examine every bridge with the particular object of deciding whether or not it shall be rebuilt in the next 12 months.

Sometime in October or November, the chief engineer examines our trestles, carrying with him the supervisor of bridges and buildings or assistant engineer having charge of the bridges on the division. On most of the divisions he examines almost every structure, but on this division he usually examines only those

structures which I recommend for rebuilding, and he decides whether to approve my recommendations or not.

In addition to the inspections above named, I ride on the engine of one of the fastest passenger trains over the division each month. This is one of the best methods of watching bridges. In addition to the above inspection I ride a motor over the road once or twice a month, and at that time examine any bridges which I think are rather old, or which the engine riding has shown to have some defect.

M. R. Williams, General Foreman of Bridges and Buildings, Atchison, Topeka & Santa Fé Railway Company:

1. We were using zinc treated material on this division, but are now only treating piles and sway braces with zinc. Have discontinued treating caps on account of treatment making them very easily broken. Most of our piling and sway braces are creosoted and all bridge material will be treated with creosote hereafter. Have a zinc treating plant at Las Vegas and a creosote treating plant at Summerville, Texas.

2. We do not cover tops of stringers and caps in open piles and frame trestles with any liquid preparation. We use galvanized iron. We do this to insure more protection from fire, and it is an excellent safeguard.

3. Do not enclose piles or posts with a casing near ground line or in water, as we have no trouble with insects in this country.

4. The only precaution we take to protect trestles from fire is the use of galvanized iron over stringers and caps.

5. We are putting in a great many creosoted ballast decks. Our timber floors are ties made of 8-inch by 14-inch, and outside 10-inch by 10-inch creosoted, then covered with broken stone.

6. Our creosoted ballast deck bridges are as near permanent work as we can get without putting in iron bridges or concrete arches.

7. We have bridge inspector go over our division every six weeks. Has boarding car which he bills to stations ahead and makes his inspection on gasoline motor car, a Fairbanks Standard. Laborer goes with bridge inspector and assists him.

J. P. CANTY, *Chairman.*
K. S. HULL,
J. E. JOHNSON,
W. O. EGGLESTON,
H. F. MORRILL.

SUPPLEMENTARY REPORT.

By J. Burnett, Inspecting Engineer, New Zealand Government Railways:

1. No preservative is used for trestle or bridge timbers on New Zealand government railways. The timber used, Australian Ironbark, is so dense as to render creosoting impossible and so durable as to make it unnecessary. Its life is at least thirty years.

2. Beyond filling large sun cracks with tar and pitch to keep moisture out of the interior of the timber, no coating is done. In many cases where in former years timbers were tarred, decay was more rapid than in similar timber untarred. The tarring imprisoned the sap and hastened decay.

3. Piles and timbers in waters infested with teredo are as a rule cased with Muntz metal from a couple of feet below the ground line to high-water mark. Felt is first wrapped around and the Muntz metal in strips wound spirally around and secured with copper nails.

4. Water pipes supplied from high tanks are laid across several of our big timber bridges. Water buckets kept always full by the lengths men, are hung at other bridges, and where trestles have planked decks a layer of 1½ inches to 2 inches of gravel is kept on the planking.

5. No timber bridges in use with ballast above decking.

6. I prefer a skeleton top to all timber bridges. Ballast only accelerates decay by holding moisture and gives an unnecessary extra dead load to the structure.

7. All bridges are inspected and timbers tested for decay at least twice a year by special bridge inspectors, who travel over districts of from 200 to 400 miles, according to the number and extent of bridges. The bridge inspector carries auger, mallet and chisel and makes a full examination of each part of each structure.

By C. H. Biss, New Zealand Government Railways:

1. No, not liked so far as I am aware. An exceptionally strong and durable timber, Australian Ironback, is used.

2. No. Patent roofing material has occasionally been used on top of stringers to which decking is spiked.

3. No. Experiments indicate that no sheathing except metal gives a practicable defence against marine worms.

4. No precautions are taken except tanks, hose and fire buckets on the larger structures, where constructed of native soft timber. The climatic conditions affect the class of timber now being used in such a manner as to render risk from fire very slight.

5. A few trestles were originally constructed with ballasted floors. After about twenty-five years' service they are being replaced by steel structures and only two or three of the former now remain.

6. I consider the chief disadvantage is the increased cost of repairs; the chief advantage a large measure of protection from fire.

7. Each division of from 300 to 400 miles is provided with a bridge inspector, who reports four-weekly through the foreman of works to the divisional engineer. Trestles are not inspected at definite stated intervals, but would probably be examined about four times a year.

J. P. CANTY, *Chairman.*

DISCUSSION.

Mr. Canty.—In investigating this subject we thought it would not be advisable to try to cover the whole field of trestle building, as it would appear to be more profitable to take up only a portion of the subject and discuss that portion thoroughly. Therefore, we have carried our research along on the line of investigating ballast covered trestles.

You will read in our paper that the Louisville & Nashville, the Southern Pacific, the Santa Fé and several other southwestern railroads are using ballast covered trestles extensively. You may also note that many representatives of railroads in the other sections of the country think that this style of trestle, while possesing many merits, will undoubtedly be troublesome to inspect and maintain after a structure has been in use for twelve or fifteen years.

Perhaps some of the representatives of the roads which are using this design, if there are any present, can give information in addition to what has been brought out in our paper on ballasted trestles.

President.—This is a broad and important subject, and I would be glad to hear from those who have had experience in this line.

Mr. Robertson.—We use what we call a gravel deck, or gravel deck trestle, very extensively. We think it is about the best structure we have found for our section of the country. It is generally considered good for about ten to twelve years, without any repairs whatever. The trestle structure is composed of creosoted piles and caps and we do

not creosote the stringers or the covering plank. We use eight by seventeen stringers, with a fifteen-foot span, and then we cover it over with three-inch plank, and the plank is covered with rubberoid paper. We then put half an inch layer of asphalt and nine inches of gravel on that, so we have a trestle which does not need any inspection for at least ten years, and probably for a longer time. We have not had any trouble at all with the gravel deck trestles used for the last five years. We are using with those gravel decks, concrete bulk heads, and in low places we use concrete intermediate piers, instead of piles, so that a gravel deck trestle is the best style in use.

Mr. Reid.—I would like to ask Mr. Robertson about the cost of this trestle he describes. It seems to me that it would be an expensive trestle.

Mr. Robertson.—We figure that it costs about twelve dollars per foot.

Mr. Cummin.—That is, the trestle complete you estimate costs twelve dollars per foot. What is the cost of the open trestle?

Mr. Robertson.—The cost of that is eight dollars.

Mr. Cummin.—What does timber cost in California?

Mr. Robertson.—We import our timber from Oregon and Puget Sound, and it costs about $20 per thousand. Good merchantable timber delivered in San Francisco.

Mr. Lichty.—Bridge material at the mills in Washington costs from ten to fourteen dollars per thousand feet. The cost of transportation adds largely to the expense of bridge building in the East.

Mr. Heflin.—Are regular roadbed ties placed on top of this nine inches of gravel which is first put on the floor?

Mr. Robertson.—Yes, sir. Regular roadbed tie 7 x 9 inches.

Mr. Heflin. As I understand the method, the floor is first covered with the rubberoid, or some other kind of paper, then asphalted and afterwards the stone ballast of nine inches is laid on. Of course, the timber would not

get very much water on it and that would make it last twice as long as in an ordinary open trestle.

Mr. Cummin.—I have never built a gravel roof trestle, but I have had some experience with creosoted piles. I cannot tell how long they will last, but judging from an incident, which was to me an interesting one, I have concluded that their term of life is, to say the least, an extended one. In the year 1882 some creosoted piles were placed in Jamaica Bay, and just before coming to the convention I had the top of one of them cut off. I wrapped this in thick paper and placed it, unfortunately for myself, in my trunk. There was still sufficient strength in the creosote to saturate the paper and some clothing with which it came in contact. This pile was made of yellow pine. I have also brought for your inspection a piece of spruce piling, which was not creosoted and which, as you can see, is badly decayed and eaten by the teredo.

Mr. Robertson.—That is the object of putting asphaltum on to make it water-tight.

President.—Then I infer it is water-proof deck or roof?

Mr. Robertson.—Yes, sir, that is the object.

President. Under those conditions it would last almost indefinitely.

Mr. Killam.—We have a pile bridge with creosoted piles that was built in 1882. This is an open pile trestle bridge. Some four years ago, the stringers and caps were found to be in need of repairing and a new top was put on the piles and these are not decayed a particle as yet. There are absolutely no signs of decay in the creosoted piles and to all appearances they will last indefinitely. If this trestle was made water-tight so as to shield the stringers and caps from water, there is no doubt in my mind that the tight deck would endure for an unlimited length of time.

Mr. Reid.—Are those piles in fresh water or salt water?

Mr. Killam.—In salt water.

Mr. Lichty.—While in the Puget Sound country during the past summer, I took occasion to inspect the piling in

the docks and wharves in the salt water. Unprotected piles there last, usually, from twelve to thirty months, I have been told, on account of the action of the teredo, but recently they have been using creosoted piles, which are not harmed by the teredo. They are using fir on the west coast, in the Puget Sound territory.

Mr. Cummin.—I do not know whether the location has any effect on the teredo or not, or what makes them more active in one place than another, but my experience on Long Island has been that the most troublesome place we have is at Oyster Bay. They seem to be more mischievous there than in any other locality known to me. They destroyed one pile there in ten months.

Mr. Reid.—I would like to ask Mr. Lichty for further details in regard to timber on the Western coast. We are using fir stringers and have more or less difficulty in obtaining the grade we desire. I would like to ask Mr. Lichty, or any of the other members who know, which is the best grade of fir.

Mr. Lichty.—I do not know that I can give Mr. Reid a satisfactory reply, except to say that I learned from bridge men while in that territory that they consider the small grained red fir the best. They have a large amount of white fir timber which they do not like to use for any outside work and if it is exposed to the weather it will not last as well as hemlock or tamarack.

As in any other locality, there is a great demand there for the best grades of lumber for other uses and the best material naturally does not find its way into bridges and such structures, but goes into finishing lumber, cross arms for telephone and telegraph lines, and so on. Some of the railroads have representatives there who are willing to pay a higher price for certain classes of material and consequently they secure a better grade than they would otherwise.

Mr. Reid.—Is it not entirely practicable to cut the bridge stringers from a better grade of lumber, or from the select

grade, and to get material that is practically clear and free from sap, if the roads will pay the price for it? We had quite an argument on that question a short time ago, when we put in a requisition for 8,000, 9 x 18 fir stringers, and they said it was practically impossible to get them under our specifications.

Mr. Lichty.—My opinion is that there will be plenty of good quality fir timber along the Western coast to supply the railroads with bridge timber for the next forty to fifty years. Prices will increase as the timber becomes more scarce and more remote from the main lines of railroads.

Mr. Reid.—Do you think that by sending a representative out there we could get a better grade than by buying from Chicago?

Mr. Lichty.—There's no question about it.

Mr. Reid.—We began putting in fir stringers in 1896. Two weeks ago I made an inspection of our Michigan and Northern Indiana branches, and of all the fir stringers I saw there, numbering several thousand, there were only three that were rotten, in over six hundred miles of track. Some of them have been in service ten years. Nearly all of the ten-year-old stringers are apparently as good today as when they were put in.

President.—Is there anything further to be said? If not, we will pass to the next subject, number two, Steel Bridges.

STEEL BRIDGES.

(Subject No. 2.)

No Report.

DISCUSSION.

President.—Messrs. Snow and Schall are the only members present of the committee appointed to report on steel bridges. I have had some correspondence with the chairman, Mr. Cunningham, in regard to this matter, and he wished to know on what line he should treat it, and I told him that was left entirely to the discretion of the committee.

Mr. Schall.—I confess, I have not done any work on this subject as far as a report to this convention is concerned. The subject is very broad and while much may be said in regard to steel bridges there is nothing new to report on the subject. The question of fully protecting the existing bridges against the effects of rust and gases is an old one, but has not been solved satisfactorily.

President.—If there is to be no discussion on this subject, we will pass on to the next, which is number three, "Buildings."

BUILDINGS.

(Subject No. 3.)

(*No report or discussion.*)

WATER SUPPLY.

(Subject No. 4.)

(No Report.)

DISCUSSION.

President.—Gentlemen, we are ready for discussion on subject number four, "Water Supply."

Mr. Alexander.—The subject of water supply is one which is all-important in railroad work. Last year I did not attend the convention, though I answered some of the questions of the committee in regard to the protection of water in tanks from frost. At that time I advocated heating the water, to a considerable extent, in pumping it, and I still find this plan satisfactory. I noticed that a good many of the members did not approve of my method. However, I shall still continue to use it, and if some of the members will visit our works on some cold day they will be, I am sure, impressed by it. We do not have any ice in our tanks. We use the exhaust steam from the pump in our suction pipe and it does not cost us any more and does not affect the pump. However, we have had some trouble with the hoops bursting and I have thought it would be a very good plan to use a round iron hoop instead of a flat one, as it would be very much more easily taken care of, and painted, and would not be so readily affected with rust. I should like to hear the opinion of some member concerning the matter.

Mr. Heflin.—I have had a good deal of trouble with flat hoops, that is, the kind made and sold by the persons who furnish the tanks. We had a couple of tanks where the hoops burst and the tank fell. The trouble with the flat hoops is that they are painted and kept looking well on the

outside, but they rust on the inside, and for that reason I think the round rods better. A three-fourths inch round rod will sustain as much pressure in a tank as a three-sixteenth inch by three-inch flat bar and there is better chance to paint it, because the greater part of its surface is exposed. However, the standard is the flat hoop.

Mr. Lichty.—I prefer the iron hoops, but for a tank of 50,000 gallons' capacity the cost is about $19 more than that of the steel hoops. It seems to me that the steel hoops might be well painted and made to last as long as the iron hoops. I do not like the round hoop as well as the flat, for as soon as a round hoop is tightly drawn up it breaks the fibres of the wood and makes a V-shaped space which will catch water and so expose the wood to decay.

Mr. Cummin.—I think one defect in the standard tank hoop is that it is of too light weight. We used to paint the inside of the hoops, but some of them burst and had to be replaced. I ordered complete sets of galvanized iron hoops, thicker and wider than the original hoop, and as fast as the old ones give out we are replacing them with galvanized material with good success.

Mr. Mills.—I agree with Mr. Cummin. I think the tank hoops, as a rule, are altogether of too light weight. The action of the air from the salt water, especially along the Hudson River, rusts them out very quickly. I think the hoops are not heavy enough and that they should be built of muck bar iron, but when I order such iron, I receive steel. I believe this is on account of the steel being cheaper. I think they are eighteen or nineteen dollars per set cheaper than the iron hoops.

Mr. Lichty.—I would like to ask how long the galvanized iron hoops have been in use of which Mr. Cummin speaks, and if they withstand the salt water air.

Mr. Cummin.—Better than the black iron. We have been using the galvanized iron hoops for about three years.

Mr. Lichty.—Do you galvanize the edges of the hoops?

Mr. Cummin.—Yes, we galvanize the edges after the galvanized sheets are cut into hoops.

Mr. Eggleston.—I have in mind a tank that was built over thirty years ago of white pine, with hoops of wrought iron. I saw that tank a few days ago and it is in a good state of preservation, with the same old hoops that were put on originally. I know of a number of tanks that have been in use twenty-five years, with wrought iron hoops, and they are in good condition yet. I also know of two or three cases where tanks have been built of late years with steel hoops, and the hoops are breaking and have had to be replaced.

Mr. Alexander.—The tanks of which I spoke were erected by Fairbanks, Morse & Co., and held a capacity of 50,000 gallons, encased by twelve hoops, the lower ones are six inches wide, the next two are five and one-half inches, the next two five inches, the next two four and one-half inches, etc., and the strength of the hoops is adequate until the rust makes them useless.

President.—I would like to ask a question and that is, if any of the members have noticed that different kinds of wood affect the hoops differently?

Mr. Perry.—My experience leads me to believe that tanks made of white pine do not affect the hoops unfavorably, but cypress and cedar tanks cause the hoops to rust.

Mr. Large.—I have had quite a long experience with water tanks and I never knew an iron hoop to break, but during the last five or six years, our company has been adopting the steel hoop, of the standard sizes, and since that time, every few months, I receive notice that hoops have broken. I think the reason is because they are steel and not iron. Iron will not break, or at least the iron hoops do not break.

Mr. Reid.—I think the Bessemer steel that is manufactured now is too uncertain in its lasting qualities for tank hoops, and I think that accounts for many of our failures.

Possibly, if we could get open hearth steel, the hoops would last longer.

Mr. Killam.—On the Intercolonial Railway I have never heard of the hoops giving out. We have only used one kind of material in the staves of the tanks and that has been used invariably. The hoops are put on, three eighths of an inch thick and are graduated in width from six inches at the bottom to three inches at the top and spaced about eight inches apart at the bottom, coming up to about nine inches apart at the top of the tank. The tanks are of 52,000 gallons capacity, and when we have occasion to rebuild a tank, we generally put the old hoops back on, and in no case have the hoops ever given way. There may be better preserving qualities in pine than in any other wood, but that is our mode at present of constructing our tanks. Using clear white pine, four inches thick, it lasts better than any other wood employed, and the hoops have never given out so far as I know.

Mr. Alexander.—I think all the tanks that we have had are built by the Fairbanks-Morse people, and I know that they are white pine, or Michigan pine. All are of the same class of wood and I presume the hoops made have been iron. Many of the older tanks show no signs of weakness yet, while some of those built more recently are giving out.

President.—There are others here who must have had experience in this line. Perhaps Mr. Flynn will speak.

Mr. Flynn.—I have had some experience with broken hoops on tanks, and they have almost always broken back of the lug, but we have always found the rest of the hoop in good condition, and under the hoop the wood perfectly sound. We have had two or three hoops on water tanks break this spring. The breaks occurred at our large terminals and were caused by the coal gas which escaped from the large number of engines standing near them.

Mr. Lichty.—Were the hoops of iron or steel?

Mr. Flynn.—Iron, I think. We watch our older tanks very closely and keep them reinforced with additional hoops on tanks, especially where the break occurs under the lug, which is apt to happen at any time.

President.—We find that steel hoops on our cedar tanks, which have been in use from eight to ten or eleven years, are in bad condition. And for that reason we think that cedar has a bad effect on steel, rusting it out very rapidly.

Mr. J. H. Markley.—About eighteen years ago I took down an old tank that had stood for twenty years and was hooped with good iron hoops. I put these hoops on a new tank. Now I am about to tear down the latter and from all appearances the hoops, after thirty-eight years of service, are far better than the steel hoops that are manufactured at the present time. I took seven steel hoops off one tank this year that were in use but ten years and they were badly rusted. Before using steel hoops on new tanks I give them two coats of red lead and Herndon's Japan oil and allow the mixture to dry hard before putting the hoops in place.

FIRE PROTECTION.

(Subject No. 5.)

REPORT OF COMMITTEE.

BALTIMORE, MD., September 20, 1906.

To the Association of Railway Superintendents of Bridges and Buildings:

The question of fire protection is one that at the present time is receiving more or less attention throughout the civilized world, and is probably at present being more closely studied by architects and engineers than at any time in the history of either profession. Baltimore's great fire of 1904 and that of San Francisco in the present year, both appalling in their loss, have set the greatest minds of the world to studying the problem and deciding on what is the best character of construction to resist the ravages of fire. In both of the above named fires, massive buildings considered in their day as almost fireproof, and surely fire resisting, crumbled into dust and remains of them were lying in the street within 20 or 30 minutes from the time fire attacked them. In many of the steel buildings the steel structures were twisted out of shape, opening the masonry and quickly disrupting the same. Massive brick buildings with floors composed of steel beams and hollow tile, quickly became a prey to the flames and nothing remained but a semblance of the original shape.

In view of these facts it becomes a difficult problem for your committee to know just where to begin. After considering the question, and in view of the fact that the subject is a standing one, we have deemed it wise in this, the beginning of the report, to confine the question to one of suggestions as to character of buildings best calculated to resist fire, both on line of road and cities, together with suggestions of methods for protecting all structures against fire.

We quote from the Philadelphia *Ledger* an item of interest to all concerned, and one that will no doubt startle many:—

"There is no feature of the national life of America upon which patriotic Americans can dwell with less pride than upon the record of our waste by fire. For the first half of this year the fire loss of the country aggregated $367,665,000. a sum greater by nearly $100,000,000 than the entire customs revenue of the United States government. Of course, this enormous aggregate includes an abnormal item—the losses from the San Francisco conflagration—but when the experts who formulated the estimates can say no more of the losses (other than those credited to San Francisco) than that they are 'normal,' the exhibit is a melancholy one.

"That a modern civilized nation can view with indifference, and almost complacency, the consignment to the flames of from nine to twenty-five millions of treasure every month—to take no account of catastrophies like those of Baltimore and San Francisco,

is one of the phenomena which it is difficult to explain. That every month of 1906 shows a greater fire loss than the corresponding month of 1905, indicates that no actual progress has been made toward improved conditions. It may well be that better construction and protective appliances have prevented still greater fire losses, and that the property destroyed represented in large measure the older and less protected construction. Notwithstanding, this record of annual waste is a disgrace to the country and an economic crime."

FRAME STATIONS AND FREIGHT HOUSES.

Where neither town nor city water supply is available a number of barrels should be kept well filled with water with a bucket at each barrel. One or more modern fire extinguishers of Holliday, Babcock or similar type, should be placed at convenient points, preferably in the offices, and all employés should be thoroughly drilled in their use.

There is now on the market an appliance known as the safety fire bucket tank, manufactured by the Safety Fire Extinguisher Company, Spalding Building, New York, which appears to possess excellent advantages. The apparatus consists of six heavy galvanized iron buckets submerged in an iron tank filled with a chemical solution which, coming in contact with the flames, generates a gas which, it is claimed, possesses many times the fire-quenching powers of plain water. The solution is made from a powder supplied by the manufacturers and is said to be non-freezing. This is submitted as a substitute for the barrels of water.

In the construction of this character of buildings no metal flues or chimneys should be used, but in all cases chimneys should be made of brick with fire-clay flue linings.

Whenever and wherever it is desirous of erecting frame buildings, either as a matter of economy of necessity, all buildings built in groups and joining each other, such as roundhouses and shops of various kinds, etc., each building should be separated from the other by brick fire walls running through the entire width of building from face to face of weatherboarding, and up through the roof to a height of at least two feet. Any doorways in this wall should be provided with an approved automatic fire-door, thus, in case of fire in one portion, the other portions are practically cut off from the burning part.

In cities and towns, and at shops where good water supply is available, the buildings should be equipped with a fire line running through the building, with a hose connection, reel and hose at points not more than 200 feet apart. Fire hydrants should also be placed at convenient points on the outside of the buildings, with small hose house at each hydrant, equipped with fire hose, axes, nozzles and spanners. At these points the hose should always be attached to hydrant, and the hose so folded on racks or reels so that taking hold of the nozzle end and working towards the fire, the hose will unwind without interference. A print of house suitable for this purpose is submitted herewith. Where not convenient to place individual houses at each hydrant, a house should be provided at the most convenient point and

equipped with a two-wheel hose carriage furnished with sufficient hose to reach the building from the fire hydrants.

In addition to the above named appliances, the building should be equipped with hand extinguishers, as spoken of for country buildings.

In most cases the character of construction is governed by the building laws of the cities and towns, but where not so covered, it is to the best interests of all concerned to design all buildings as if controlled by city building laws, thus assuring protection against fire as well as reducing insurance premiums.

In the equipping of the buildings with water supply as above outlined, the necessity for thorough drilling of the employés must not be overlooked, otherwise in case of fire the lack of knowledge in the use of appliances will make the installation of same useless.

In large warehouses the installation of an automatic sprinkler system is recommended, and of which there are several designs in the market. The character of design should, of course, be left to the engineer or architect, but we feel that we are not infringing on their prerogatives when we mention the following as good examples:

For roundhouses and shops:

Reinforced concrete.
Brick.
Steel and brick.

For freight houses:

Reinforced concrete.
Brick.
Steel and brick.
Steel and stone.
Slow burning or mill construction.

Stations:

Brick.
Stone.
Reinforced concrete.

Office buildings:

Steel skeleton construction.
With brick, concrete or stone, as may be desired.

Details of this work will not be entered into by this committee, as they are well covered by standard works on building construction, a number of which will be found named later on in this paper.

A list of fire protection rules now in use by the B. & O. R. R. Co. is submitted herewith. This, where strictly adhered to, has been found very efficient.

TO ALL OFFICERS AND EMPLOYEES.

No. 1. Smoking is prohibited in shops, freight and warehouses, and at all points where inflammable materials are handled.

No. 2. All defects which tend to increase risk of, or cause fires, should be attended to or reported at once to the officer in charge.

TO AGENTS, MASTER MECHANICS, SUPERVISORS OF BRIDGES AND BUILDINGS, SUPERVISORS OF TRACKS, OPERATORS AND ALL OTHERS IN CHARGE OF COMPANY'S PROPERTY.

No. 3. Dirt, rubbish and inflammable material must not accumulate in or about the shops, stations, warehouses, buildings or premises of the company.

No. 4. Greasy and oily waste, or old rags used in cleaning cars or varnished surface, must be kept in covered metal cans. They must not be allowed to accumulate in or about buildings or premises and should be removed each night, as they are liable to cause fire by spontaneous combustion.

No. 5. Sand may be used on floors and in spittoons. Sawdust must not be so used.

No. 6. The use of matches in and around buildings should be avoided as much as possible; but when they are necessary, safety matches should be provided and care taken to see that they are extinguished after being used, and when kept in stock, metal boxes should be provided for them.

No. 7. Supplies of benzine, gasoline or naphtha may be kept only in buildings especially intended for oil storage.

No. 8. The use of gasoline stoves or gasoline ranges, for cooking or heating purposes, in stations, warehouses and other buildings, is prohibited.

No. 9. Where there are locked city fire alarm boxes near or in shops, stations, warehouses and other buildings, the key must be procured and hung up in a well-known and accessible place.

No. 10. Hand torches for use of workmen in roundhouses and shops must be kept in metal cupboard provided for same.

No. 11. Well ventilated closets for workmen's clothing and tools should be provided in roundhouses and shops. Closed closets should be prohibited.

No. 12. Fire casks must be kept filled, and salt added to the water in them where it is likely to freeze. Hose, plugs and other fire appliances must be tested and kept in good condition; fire brigades organized at shops and large stations and drilled at least monthly, and employés instructed as to the use and method of handling fire extinguishers and chemical engines. A good supply of casks and fire-pails should be provided in all shops, freight stations, warehouses, coal tipples, and on piers, wooden bridges and trestles.

AT ALL POINTS WHERE OIL IS USED FOR ILLUMINATING PURPOSES THE FOLLOWING RULES SHOULD BE OBSERVED.

No. 13. Coal-oil lamps with glass fonts are objectionable, and should not be used unless approved by the insurance department. They must not be filled after dark or near fire, as the oil when low generates an explosive gas. Paper shades must not be used.

No. 14. Oil for company's use in shops, stations, towers, freight and warehouses, should be kept outside of main buildings. Whenever it is possiole to do so, arrangements should be made to take care of it in the coal house or other small outbuilding. If this is not feasible, a metal-lined box should be provided in which to keep the cans.

AT POINTS WHERE STOVES ARE USED FOR HEATING PURPOSES.

No. 15. Stoves for heating buildings should be securely set on stone, cemented brick or metal. Woodwork near stoves or stove-pipes must be protected by sheet metal, and air spaces provided where stove-pipes pass through woodwork. Where such pipes pass through record and file rooms care should be taken to see that papers are kept at a sufficient distance from same.

No. 16. Ashes must be kept in metal cans and removed each day. Ashes must not be kept in wooden boxes, nor thrown against the side of buildings.

AT POINTS WHERE STEAM, GAS OR ELECTRICITY IS USED FOR POWER, HEATING OR LIGHTING PURPOSES.

No. 17. Steam-pipes must not be placed too close to woodwork and should be kept free from greasy or oily waste and other inflammable material. Overalls or clothing must not be hung on or near steam-pipe.

No. 18. Rigid gas fixtures are to be preferred and should be used. Where swinging brackets are necessary they must be so protected that the flames cannot reach woodwork or other inflammable material.

No. 19. Electric light, telegraph and telephone wires in buildings must be properly insulated and equipped with safety devices. They should be overhauled and inspected regularly and brought up to standard condition, especially in buildings where the wiring has been installed for some time. All telegraph and telephone wires, before entering buildings of the company, should be protected by lightning arresters, and, in cases where they are liable to come in contact with high tension wires, excessive current protectors. Before the electric current is turned on, all new work must be inspected and approved by the board of fire underwriters or the insurance inspector.

No. 20. Requisition should be made promptly for supplies necessary to carry out the instructions contained in the above rules.

TRAIN MASTERS, YARD MASTERS AND CONDUCTORS.

No. 21. Rolling equipment must not be allowed to stand near elevators, mills, on piers or in warehouses, longer than is necessary.

The following specifications are submitted for installation of fire supply pipe, the size of pipe being left blank to be filled in to suit local requirements:

Connect to nearest main a ——inch heavy pressure C. I. pipe running thence to house at which point it is to be supplied with ——inch gate valve of approved design, the pipe then to be run under ground to a point 75 feet from each end of same; at points 150 feet apart a heavy pressure C. I. standpipe of 4-inch diameter is to be run from cellar to roof; on this pipe, at a point not more than 5 feet from each floor, including cellar and roof, is to be placed a 2½-inch single gate hose valve of approved design, each valve to be supplied with 150 feet of 2½-inch rubber-lined linen

hose, one swing hose rack or reel (as may be desired), one nozzle, one hose spanner and necessary fittings, the hose to be connected to valve and so folded on rack or rolled on reel that by taking hold of nozzle and running towards fire the hose will unwind without interference. All vertical pipes to be fastened to the walls by strong wrought iron hooks not less than 4 feet apart. Each standpipe shall be provided with one two-way two and one-half-inch (2½-in.) automatic Siamese at the bottom of each standpipe placed on the front of building facing the street above the curb level. Said Siamese shall be within four (4) feet distance from the top of the sidewalk and be securely anchored to the wall of the building.

All joints in the pipe to be caulked with lead in a thorough and workmanlike manner. The contractor is to furnish all labor and material for the proper performance of the work and take out and pay for all necessary permits. All work to be done strictly in accordance with the laws of the city in which the work may be done and subject to the inspection and approval of the authorized city inspectors and the authorized inspector of the board of fire underwriters.

All work should be performed under the direction of the authorized representative of the railroad company for whom the work is being done, and subject to his inspection at all times. No change is to be made in these specifications except by the written orders of the representative of the said railroad company.

In drawing specifications for the above class of work it may be found desirous or necessary to hang the supply pipe to ceilings or walls. In that case the pipe should be hung by heavy wrought iron hooks not more than 3 feet apart and all pipe thoroughly covered with some heavy insulating material to prevent freezing; wrought pipe of suitable thickness to suit pressure may also be substituted for the cast iron pipe specified.

In connection witn this matter it should not be necessary to call attention to the fact that all interested should be familiar with the building laws of the cities in which their work may be located, but for the benefit of those who are not familiar, we give herewith extracts from the building laws of the City of Cleveland, Ohio, governing the use of standpipes and pumps in buildings. These are clear and concise, and are well worth studying:

SECTION 1. *Standpipes and hose.*—Every building hereafter erected, of greater height than 75 feet, but not exceeding 150 feet, shall be provided with a 4-inch standpipe running from the cellar to the roof, and all buildings of a greater height than 150 feet, now or hereafter erected, shall be provided with standpipes not less than six inches in diameter, running from the cellar to the roof, and with one 2½-inch outlet, with hose attached thereto on each floor, including cellar and roof, and placed as near the stairs as practicable, but no outlet shall be placed more than 5 feet above the floor level.

Nothing in this section shall be so construed as to prevent the use of 1½-inch or 2-inch hose connections, or hose with proper reducers attached to the 2½-inch regulation outlet in any other building, or part of a building, provided the use of such shall not be in conflict with any regulation of the fire department.

SECT. 2. *Siamese.*—Each interior or exterior standpipe shall be provided with one two-way 2½-inch automatic Siamese at the bottom of each standpipe placed on street above the curb level; said Siamese shall be within four feet distance from the sidewalk and be securely anchored to the wall of the building.

SECT. 3. *Exterior standpipe.*—Exterior standpipes may be placed on the outside buildings not exceeding 100 feet in length. Each standpipe shall have connected with it a ladder fire escape as prescribed in Section X, Title 2. The pipe shall not be less than that of three inches standard wrought iron pipe with a 2½-inch hose valve attached to every outlet on each floor and goose-necked over and above the roof; said standpipe shall be secured to the ladders at every four feet and bolted to the balcony.

SECT. 4. *Number of standpipes.*—If any of the other buildings extend from street to street or form an L shape, they shall be provided with standpipes for each frontage.

SECT. 5. *Standards.*—All valves, fittings and couplings used in connection with standpipes shall be of the standard size and thread in use by the fire department of the City of Cleveland.

SECT. 6. *Auxiliary pumps.*—All buildings now erected, unless already provided with a three-inch layer vertical pipe, or hereafter to be erected, 150 feet or more in height, shall be provided with an auxiliary fire apparatus and appliances, consisting of water tank on roof, or in cellar, pumps, standpipes, hose, nozzles, wrenches, fire extinguishers, hooks, axes and other fire apparatus, located and accessibly placed under the direction of the chief of the fire department.

SECT. 7. *Inspection.*—All valves, hose, tools and other appliances, provided for in this section, shall be kept in perfect working order, and once a month the person in charge of said building shall make a thorough investigation of the same to see that all valves, etc., are in perfect working order and ready for immediate use by the fire department.

SECT. 8. *Pumps and elevators in readiness.*—In every building over 150 feet high a steam or electric pump and at least one passenger elevator shall be kept in readiness for immediate use by the fire department during all hours of the day or night, including holidays and Sundays, the said pump, if located in the lowest story, shall be placed not less than two feet above the floor level.

SECT. 9. *Boiler pit.*—The boilers which supply power to the passenger elevators and pumps, if located in the lowest story, shall be so surrounded by a dwarf brick wall laid in cement mortar, or other suitable permanent waterproof construction, as to exclude water to the depth of two feet above the floor level from flowing into the ash pits of said boilers.

SECT. 10. *Cesspool.*—When the level of the floor of the lowest story is above the level of the sewer in the street, a large cesspool shall be placed in said floor and connected by a four-inch cast iron drain pipe with the street sewer.

SECT. 11. *Sewer connection.*—In all buildings used or intended to be used for merchantile or manufacturing purposes, and located where a sewer connection can be made, there shall be in the cellar or basement, a sewer connection which can be immediately opened for the purpose of drainage in case the building or any of the floors or basement or cellar thereof should be flooded

from any cause, and the location of said sewer connections shall be as near the main stairs as possible and shall be indicated by a permanent and conspicuous sign on the wall near the ceiling, and such sign shall never be hidden or obstructed, but shall always be in plain view.

It is to be understood that this paper is submitted by your committee as a preliminary one only, and which it is hoped will be continued by future committees.

GEO. W. ANDREWS,
Chairman.

R. A. NICKERSON.
W. H. KEENE.
D. C. ZOOK.

(*No discussion.*)

FENCES, ROAD CROSSINGS AND CATTLE GUARDS.

(Subject No. 6.)

No Report.

DISCUSSION.

Mr. Reid.—We have several cattle guards on the Lake Shore Road and so far as I know they are giving fairly good results. I see them only as I go back and forth over the road. They are easily removed whenever it becomes necessary to repair the track and do not take fire. When I first saw them, I had an idea that they would be easily broken and whether they will prove to be a success I cannot attempt to say.

Mr. Cummin.—We have a number of those tile cattle guards at the crossings over the tracks where we have an electrical third rail; presumably, in order not to reduce the population of Long Island too rapidly, and so far as I am aware they are doing good service.

Mr. Reid.—We have some iron cattle guards, but the iron guards are easily destroyed, and if they become buckled, it is difficult to do anything with them and it becomes necessary to remove them. I think the tile guards are as much of a success as the iron guards. I consider either the wood or the tile guards much better, but I think there is a wide field for improvement in this particular line.

Mr. Clark.—On the Philadelphia and Reading Road and on the New York, New Haven and Hartford Road, I have seen a cattle guard that I feel sure the animals would find difficult to pass. A portion of the guard was smooth, and about every four inches from the plain part was a saw tooth, about two inches long, and coming to a sharp point.

I do not know how great a test this would endure, but I think it would be a formidable obstacle for the cattle to encounter, and I would certainly advise the brakemen to go around it. With us the cattle guard is almost an obsolete factor. According to the laws of the state of Ohio, the cattle are not allowed to be in the highway, and consequently there is not much need of a guard. But, of course, there are a great many places where we are required to keep up the cattle guards; that being the case, we use, invariably, the old wooden slat guard.

Mr. Rettinghouse.—The lawmakers of Wisconsin and Michigan are not very lenient in their requirements concerning cattle guards and we would like to have a law enacted there similar to the one practiced in Ohio, and I am sure our railroad men would appreciate it. A great deal of experimenting has been done by the railroad corporations in that section of the country and all kinds of patent guards have been tried, but they have nearly all been discarded and the wooden slat guard is in general use. Some time ago we tried a patent guard something like the one described by Mr. Clark, with barbs sticking up. Shortly after it was put in we received a letter from an adjacent farmer, in which he said, "Please take out that guard; it hurts the feet of my cattle." Consequently, I think that this guard must have some merit. (Laughter.)

Mr. Fake.—We have a very difficult class of stock with which to contend, and we have used nearly all the sheet metal guards in the market, without success. We now use the old-fashioned pit guard, with ties applied in the same manner as on the trestles, the only difference being that these are turned up corner-wise, or in diamond shape, using two-ply eight by sixteen stringers. It is an expensive guard, costing about sixty dollars, including the labor, It has been entirely successful with the cattle. Runaway horses have jumped over, but have never become entangled in them.

Mr. Rettinghouse.—I believe that there is no question of the old-style pit cattle guard being the only successful one for turning cattle. Several years ago on the C. & N. W. Ry., a farmer in the mining region of Northern Michigan was selling all his old cattle to the railway company. Cattle were being regularly killed at certain crossings where we had surface guards. The slaughter, and the accompanying expense of settling with the farmer, became so great that it was finally decided to put in pit cattle guards very much the same as has been described by a former speaker. Owing to the severe climate, we found it a very hard matter to keep these guards in surface during the winter, as they would heave to a considerable extent, causing a very rough track. We overcame this by putting them on pile foundations and virtually made of them a pile bridge. They were made 10 feet long, costing about $70 per guard, and they gave excellent satisfaction.

Mr. Eggleston.—I observe that we have some newcomers here and we would be glad to listen to some remarks from these gentlemen.

President.—We would be very glad to hear from the new members as well as from the older ones.

Mr. Heflin.—I was employed on the B. & O. Road for twenty years. They had pit guards and used stringers over the pit to carry the rail. It was concluded by our people that the pits were dangerous, because a guard from six to eight feet long could not be kept with any certainty of having a good solid track. So we dispensed with the pit guard and adopted surface guards, using three-corner strips, sharpened at the top. The Lehigh Valley Road use the same arrangement. They were found to be dangerous and were likewise discarded. I do not know any guard that will successfully turn the stock. However, the laws require their use.

President.—Is there anything further to be said on this subject? If not, we will close it and take up the next subject, number seven, "Preservatives for Wood and Metals."

PRESERVATIVES FOR WOOD AND METALS.

(Subject No. 7.)

REPORT OF COMMITTEE.

WEST OAKLAND, CAL., September 1, 1906.

To the Association of Railway Superintendents of Bridges and Buildings:

After sending out numerous circular letters asking for information on this subject, your Committee beg to submit the following:

Wood preservation and preservative methods, although carried on very extensively during the last year, no great strides have been made towards the discovery of anything new in the way of new methods. It is true that new methods have been proposed, but like all other processes time alone can prove their real value.

One new method of wood preservation is described in the *Railway and Engineering Review* of June 30, 1906, as follows:

NEW WOOD PRESERVING PROCESS.

"A new wood preserving process, which employs sulphur as the antiseptic, is being experimented with in Germany. The following account of the work is taken from the United States Consular Reports. The sulphur is applied in liquid form, and in hardening completely fills up all the interstices of the fibrous tissue. The sulphur is fused in a receptable, making use of steam to avoid an excess of heat, which deteriorates the sulphur. Into this liquid, and at a temperature of about 140° C., is steeped the lumber which is to receive the treatment, care being taken to immerse it completely. The foam which gathers at first, called forth by the separation from the wood of the air and humidity it contains, disappears at the moment the wood thoroughly assimilates the temperature of the bath, which is then lowered to 110° C. At this point the sulphur becomes hard and, while the air contracts itself, the sulphur penetrates into the fibrous tissues, propelled by atmospheric pressure. The lumber is then slowly withdrawn from the bath, allowing a thin and even coat of sulphur to form and cover the wood, as any superfluous surcharge can be removed only with great difficulty afterwards. This coat of sulphur has a vitreous appearance and forms a very tenacious crust, excluding all tendencies to chip or break. The degree to which the wood is impregnated varies according to the nature of the wood, the temperature and the duration of the bath. It may be gauged by the increase in weight of the lumber, which amounts to from 30 to 35 per cent. where the process is conducted in an open receptacle, and to 100 per cent. if in vacuum. Theoretically it is said that a complete impregnation of the pores of the wood would increase its weight by 200 per cent. In numerous experiments poplar was found to be the

best wood to take the sulphur treatment. Oak and pine wood do not admit of the process quite so favorably, because their dry distillation begins at 140° C."

Another process which is rather unique and may prove of considerable value when properly investigated is described in the *Railway Engineering Review* of May 12, 1906, as follows:

A NEW TIMBER PRESERVATIVE.

"An interesting method of applying a preservative to railway ties and timber is described in *L'Industrie Electrique* of Paris. The process consists of the artificial metallization of the pores of the wood, the metal being deposited electrolytically. In brief, the method requires first the application of a solution of some salt, sulphate of copper, for example, by placing the wood immersed in the solution in a closed chamber and subjecting it to pressure. The wood is thus thoroughly impregnated with the solution. It is then taken out and piled up in layers in a concrete reservoir. The first layer of timber is immersed in the same copper sulphate solution and also rests on a layer of jute or other fibrous material which is supported by an electrode made of woven strands of copper. Similar electrodes are placed between each layer of timbers as they are piled up to the desired height. Alternate electrodes are then connected to the opposite poles of an alternating current supply, and the current is allowed to pass. The action is said to decompose the solution and set free metallic copper in the pores of the wood. Besides the preservative action in thus closing the pores, it is said that a certain amount of copper sulphate is permanently retained in the pores, giving an additional and decided preservative effect."

A very good paper on bridge painting is reproduced in the *Railway and Engineering Review* of August 18, 1906, by Mr. Willis Whited, read before the Engineering Society of Western Pennsylvania.

The following are communications from other members of the committee, and others, pertaining to the subject:

DULUTH, MINN., March 21, 1906.

Dear Sir: Referring to the matter of committee reports on the subject of preservation of timber, I beg to hand you herewith copy of a letter from Mr. Robert Angst, Chief Engineer of the Duluth & Iron Range Railroad, referring to some treated ties placed in the tracks of that company during the year 1890. This report is interesting and furnishes practically everything except the price of the ties. I will state for your information, however, that the average price of ties during this period was 25 cents each, delivered at the track of the railway company.

I have no further information in regard to treated timbers, but we are this year putting into our ore docks at Duluth quite an amount of creosoted timber and will be able to furnish some reliable data as soon as experience has demonstrated to us the advantage in using this class of material.

Very truly yours,

W. A. MCGONAGLE,
First Vice-President

DULUTH, MINN., February 14, 1906.

MR. W. A. MCGONAGLE, First Vice-President Duluth, Missabe & Northern Railway Company.

Dear Sir: Answering your request for a history of the treated ties in our tracks north of the St. Louis River, I beg to advise you that in the fall of 1890 this company shipped to Mr. Octave Chanute, at Chicago, one car containing 85 white pine ties, 85 tamarack ties and 86 red Norway ties for treatment by the same process under which Mr. Chanute had a long time contract with the Chicago, Rock Island & Pacific Railway Company.

These ties were cut in the territory contiguous to our tracks in the winter or early spring of 1890. They were peeled in the spring, cross piled and seasoned in the open air without cover or protection against the weather until shipped to Chicago. In the spring of 1891 they were put in the single track main line north of St. Louis River and remained there until the winter of 1895–'96, at which time grade revision and double tracking during a very severe winter necessitated the liberal use of explosives, and during this operation a number of the treated ties were absolutely destroyed, notwithstanding special care was taken to reduce the breakage to a possible minimum. The ties fit for use were put back into the track and, with the exception of perhaps a dozen, are there today, and those remaining appear to have sufficient vitality left to last another year or two.

I have no means of giving you the cost of treatment of those ties, as Mr. Chanute generously treated the same without charge to the railroad company. The process, as I understand it, is the Wellhouse process—that is, zinc-tannin. From conversation with the officials of the Chicago, Rock Island & Pacific Railway Company, I was led to believe that the cost of treating ties was in the neighborhood of 17 cents apiece—at least that is what the Rock Island people figured it. That company did not buy the crude ties, but bought the treated ties, principally hemlock from Michigan, delivered f. o. b. cars, their track, Chicago yard, near 15th Street. Mr. Chanute's plant, at that time, was located near the Charles Street bridge in one corner of the Rock Island yards.

The roadbed where those ties are consists of a gravel cement hardpan (glacial drift). The ballast is a fairly clean gravel mixed with sharp sand and some loam, which carries quite a percentage of lime.

The average life of untreated ties of the same kind of timber, cut in the winter, peeled in the spring, seasoned for twelve months after peeling, is from 7½ to 8 years. The cost at that time—that is, in 1890—averaged 20 cents for 6 x 8 inch ties, and 22 cents for 7 x 8 ties, all 8 feet long, hewed with scarfed ends, of the class usually known as pole ties. The trees were usually cut and the ties hewed and delivered on the track in December, January and February, which, as you are aware, is the best time for cutting timber. I wish to add that the tamarack manufactured into ties north of Duluth is of the species known as swamp tamarack; it has very little sap, the timber is of a rather dark color and weighs nearly as much as oak.

Very truly yours,

R. ANGST,
Chief Engineer.

LEHIGH VALLEY RAILROAD, April 2, 1906.

MR. F. D. BEAL, Supt. S. P. Co.'s Wood Preserving Works,
West Oakland, Cal.

Dear Sir: Replying to your letter of March 27, I beg to advise that we use no wood preservatives on this road, and the paints used for protective purposes on our steel bridges are furnished by the Patterson Sargent Co. of Cleveland, Ohio (their Nobrac paint), and the Rinald Bros. of Philadelphia, Pa. (their Bessemer paint), both of which have far exceeded in general utility any of the generally advertised bridge paints.

Yours truly,

E. B. ASHBY.

N., C. & ST. L. RY., PADUCAH, KY., April 7, 1906.

F. D. BEAL,
West Oakland, Cal.

Dear Sir: Referring to your favor of March 27, asking for report on wood preservation.

Would state that we have only begun using creosoted timber within the last two years and I do not suppose we have more than eight to ten carloads of creosoted piling and timber in our structures, so that we are not in condition to furnish you any definite information.

Would state that some six or eight years ago we commenced wiping some of our timber with carbolineum avenarius. The results were very indifferent and we have discontinued its use.

I do not consider that this material is worth nearly as much as it costs. In fact, whitewashing timber with a wood preservative is a rather useless expense.

Yours truly,

I. O. WALKER.

WILLIAMSPORT, PA., August 7, 1906.

MR. F. D. BEAL, Supt. of S. P. Co.'s Wood Preserving Works.

Dear Sir: Referring to your letter of March 27, 1906:

The only wood preservative we have used on our road has been creosote. This has been used principally on pile trestles along the seashore, as it has been found to prolong the life of the trestle, as well as protecting it from insects. We have had pile trestles, treated in this way, last from fourteen to fifteen years.

Referring to paint used for steel bridges and structures on our road: On new steel bridges we first give them a coat of red lead, then we have a mixture of graphite paint, of a dark brown color, which is put on for a second and third coat. This we have found to be about the best paint for our bridges. We try to have them painted once every three years.

This is about all the information I can give you on the above subjects and trust same will be of some assistance to you.

Hoping you will please pardon my delay in acknowledging your letter, I remain,

Yours truly,

W. W. PERRY,

Master Carpenter, P. & R. Ry.

SAN BERNARDINO, CAL., September 3, 1906.

MR. F. D. BEAL, Supt. S. P. Co.'s Wood Preserving Works, West Oakland, Cal.

Dear Sir: Replying to your letter of August 15 and referring to my letter of January 15, file 167, in regard to preservatives of wood and metal for the Association of Railway Superintendents of Bridges and Buildings:

I have been too busy with maintenance of way work to make up a formal report.

In regard to the preservative for metal, I beg to advise that I have not found anything that will absolutely preserve the metals from water and rust. Paints that have been used on bridges and other iron structures have been graphite and mineral red.

Graphite has proven to be of less benefit to metal than mineral red, as graphite peels up in large flakes and leaves the metal exposed. When pains and care are taken in applying mineral red and working it carefully into the grain of the iron, we have had but very little trouble from scaling or peeling off and letting water get in between the paint and the iron. It may be that not enough care is taken in applying paints to metal structures in railway operation, which, if it be true, would account for the failure of the paints to protect metal.

I regret exceedingly that I have not the time to investigate this matter more fully, but will have to defer it on account of the routine work which requires my attention.

Yours truly,
(Signed) R. J. AREY,
Division Engineer of the A., T. & S. F. Ry.

Respectfully submitted,

F. D. BEAL,
R. J. AREY,
H. SMALL,
W. A. MCGONAGLE,
Committee.

SUPPLEMENTARY REPORT.

ST. LOUIS, MO., September 6, 1906.

F. D. BEAL, Chairman Committee on Preservatives for Woods and Metals.

My Dear Sir: I am sending you recommendations for a specification of creosote which is generally being adopted and in effect in most of the large contracts.

OIL SPECIFICATION.

The oil to be used shall be pure dead oil of coal tar without adulteration, and with a specific gravity of not less than 1.045 at a temperature of 60° Fahrenheit. It must be thoroughly liquid at 100° Fahrenheit and remain so on, cooling down to 90° Fahrenheit. Up to 200° Centigrade nothing must come off; up to 210° Centigrade not more than 5 per cent. and up to 235° not more than 35 per cent. of all products shall come off, while

not more than 4 per cent. must remain as solid residuum above 355° Centigrade. Not more than 2 per cent. water shall be allowed, and if more than this, the quantity of oil injected must be increased by the total percentage of water in the oil. The distillation must be conducted under the standard method.

Yours very truly,

HERMAN VON SCHRENK,
Pathologist in Charge.

DISCUSSION.

Mr. Reid.—On the Lake Shore Road we are using a timber preservative called Avenarius Carbolineum, a particular brand which is supposed to have the qualities necessary for the proper preservation of timber. However, we have not used it for a sufficient length of time to be able to speak conclusively of its merits. Recently a circular has been sent out, ordering its application at all points where timber comes in contact with earth or stone and on all joints of the timber, such as the ends of stringers and the bearings of the caps on piles, also on the bearings of the stringers, etc. I have recommended and directed the men to use it very liberally. Some of the other members might be able to give us some information on this subject. This is the only preservative I have ever used.

Mr. A. S. Markley.—I have never believed that any benefit resulted from the application of different compositions to the surface of timber, for the purpose of preserving it, with the exception of paint. We painted, at one time, with this object in view, some Howe truss braces. A number of years afterward we found dry rot in the center of these braces. It is my opinion that they would have lasted longer without the paint.

Mr. Reid.—This carbolineum that I refer to can be applied to timber without producing heart rot, and it can also be applied to green as well as to that which has been seasoned. But of course, it is more effective on the dry or seasoned timber, because it penetrates further. I believe it to be an excellent preservative for timber.

President.—If the members have used any other kind of preservatives, we would be very glad to know about it.

Mr. Cummin.—Oil is a preservative of wood.

President.—What is the effect of kerosene in this respect?

Mr. Cummin.—I have seen a good many kerosene oil barrels, but I do not remember to have seen a rotten one, and I believe it is of great benefit to use some good preservative. I think that almost any kind of oil will help to prolong the life of the timber.

President.—Have any of the members had experience with creosote? It seems to me that the proper creosoting of timber is a decided preservative, and if not found to be too expensive, it might be applied to all timber in trestles and bridges of every kind.

Mr. Reid.—In regard to the expense of creosoting timber: while I do not know the cost, I think it is expensive.

Mr. Aldrich.—Some years ago, on the New England Railroad, a floor of three-inch hemlock plank was laid on the ground, on a pier, and covered with three-inch hard pine plank for a wearing surface. They commenced to lay creosoted hemlock plank, but could not obtain the creosoted plank in sufficient quantity so a part of it was not creosoted. Some twelve years afterwards, when we had occasion to renew the top floor, we found the hemlock that had been creosoted was as sound as it was when it was put there, but the part that was not creosoted was decayed. As to the cost: I could not tell you anything about it.

President.—Could you give us an approximate cost per thousand feet?

Mr. Aldrich.—No, I could not.

Mr. Parker.—We have been using crude oil for a number of years on all new timber, on repairs of wooden trestles and in the frame bents. We paint the entire bent, sway braces, stringers and ties with crude oil. It improves the appearance of the structure and prevents the wood from checking, and we consider it valuable for this purpose. In

case of checks on the upper side, I have filled them with crude oil and this has prevented the rain water from going in and rotting the timber.

President.—I would like to ask if you consider that it increases the fire hazard?

Mr. Parker.—No, sir. It does not.

Mr. Snow.—Do you find it necessary to renew that application every few years? I am much interested in the subject of antiseptic washes. Not so much with the idea of complete preservation of the timber as of prolonging its life, say fifty per cent. I have supposed that the antiseptic principle in crude oil would evaporate quickly and I ask Mr. Parker if this has taken place in his experience.

Mr. Parker.—We have never made a practice of repainting wooden bridges with crude oil.

Mr. Snow.—On the open pile trestle for instance: do you find that after a few years the oil has apparently disappeared? Or does it still remain?

Mr. Parker.—It never disappears entirely. Of course, crude oil is a very cheap article and costs the railroad company practically nothing. It is charged, I believe, at only eighteen cents a barrel.

Mr. Eggleston.—In reply to Mr. Snow's question about evaporation: I have seen a great deal of timber in the Pennsylvania oil fields covered in various ways with oil, and I am satisfied that there is very little evaporation.

Mr. Large.—I would like to ask Mr. Parker what he gains by the use of this paint. Does it preserve the life of this timber?

Mr. Parker.—We consider that it does preserve the life of timber. In Southern California the climate is very hot. The heat is damaging to the timber and perceptibly impairs the life of it. We put up a number of Howe truss spans about eight years ago and painted the timber with crude oil, and we considered it as good as any paint that we could use.

President.—Can you estimate the increased length of life of the timber? Will the application double the life of it?

Mr. Parker.—I would not consider that it any more than doubled the life; hardly that, perhaps.

President.—But it decidedly lengthens the life of the timber, does it not?

Mr. Parker.—Undoubtedly.

President.—Is there anything further to be said on this subject? If not, we will pass it and take up subject number eight.

No report or discussion on subject number eight.

(Records and accounts.)

LIST OF ANNUAL CONVENTIONS.

First,	St. Louis, Mo.,	September 25, 1891.
Second,	Cincinnati, Ohio,	October 18, 19, 1892.
Third,	Philadelphia, Pa.,	October 17 to 19, 1893.
Fourth,	Kansas City, Mo.,	October 16 to 18, 1894.
Fifth,	New Orleans, La.,	October 15, 16, 1895.
Sixth,	Chicago, Ill.,	October 20 to 22, 1896.
Seventh,	Denver, Col.,	October 19 to 21, 1897.
Eighth,	Richmond, Va.,	October 18, 19, 1898.
Ninth,	Detroit, Mich.,	October 17, 18, 1899.
Tenth,	St. Louis, Mo.,	October 16 to 18, 1900.
Eleventh,	Atlanta, Ga.,	October 15 to 17, 1901.
Twelfth,	Minneapolis, Minn.,	October 21 to 23, 1902.
Thirteenth,	Quebec, Canada,	October 20 to 22, 1903.
Fourteenth,	Chicago, Ill.,	October 18 to 20, 1904.
Fifteenth,	Pittsburg, Pa.,	October 17 to 19, 1905.
Sixteenth,	Boston, Mass.,	October 16 to 18, 1906.

MEMBERSHIP.

Year 1891–2. . . .	Number of active members, 60.
Year 1892–3. . . .	Number of active members, 112.
Year 1893–4. . . .	Number of active members, 128.
Year 1894–5. . . .	Number of active members, 115.
Year 1895–6. . . .	Number of active members, 122.
Year 1896–7. . . .	Number of active members, 140.
Year 1897–8. . . .	Number of active members, 127.
Year 1898–9. . . .	Number of active members, 148.
Year 1899–1900. . .	Number of active members, 148.
Year 1900–01. . . .	Number of active members, 143.
Year 1901–02. . . .	Number of active members, 171.
Year 1902–03. . . .	Number of active members, 195.
Year 1903–04. . . .	Number of active members, 223.
Year 1904–05. . . .	Number of active members, 293.
Year 1905–06. . . .	Number of active members, 313.
Year 1906–07. . . .	Number of active members, 340.

LIST OF OFFICERS OF THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS FROM ITS ORGANIZATION TO THE YEAR 1906-1907.

YEAR.	1891-2.	1892-3.	1893-4.	1894-5.
President	O. J. Travis	H. M. Hall	J. E. Wallace	Geo. W. Andrews.
First Vice-President	H. M. Hall	J. E. Wallace	Geo. W. Andrews	W. A. McGonagle.
Second Vice-President	J. B. Mitchell	G. W. Hinman	W. A. McGonagle	L. K. Spafford.
Third Vice-President	James Stannard	N. W. Thompson.	L. K. Spafford	James Stannard.
Fourth Vice-President	G. W. Hinman	C. E. Fuller	E. D. Hines	Walter G. Berg.
Secretary	C. W. Gooch	S. F. Patterson	S. F. Patterson	S. F. Patterson.
Treasurer	George M. Reid	George M. Reid	George M. Reid	George M. Reid.
Executive Members	W. R. Damon	G. W. Andrews	Quintine McNab	James Stannard.
	G. W. Markley	Joseph M. Staten.	Aaron S. Markley	James H. Travis.
	W. A. McGonagle	J. M. Caldwell	Floyd Ingram	Joseph H. Cummin.
	G. W. McGehee	Quintine McNab	James Stannard	R. M. Peck.
	G. W. Turner	Floyd Ingram	James H. Travis	J. L. White.
	J. E. Wallace	Aaron S. Markley	Joseph H. Cummin	A. Shane.

YEAR.	1895-6.	1896-7.	1897-8.	1898-9.
President	W. A. McGonagle	James Stannard	Walter G. Berg	Joseph H. Cummin.
First Vice-President	L. K. Spafford	Walter G. Berg	Joseph H. Cummin	Aaron S. Markley.
Second Vice-President	James Stannard	Joseph H. Cummin	Aaron S. Markley.	C. C. Mallard.
Third Vice-President	Walter G. Berg	Aaron S. Markley	G. W. Hinman	Walter A. Rogers.
Fourth Vice-President.	Joseph H. Cummin	R. M. Peck	C. C. Mallard	Joseph M. Staten.*
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson.
Treasurer	George M. Reid	N. W. Thompson	N. W. Thompson	N. W. Thompson.
Executive Members.	R. M. Peck	W. O. Eggleston	George J. Bishop	Wm. S. Danes.
	J. L. White	W. M. Noon	C. P. Austin	J. H. Markley.
	A. Shane	Joseph M. Staten	M. Riney	W. O. Eggleston.
	Aaron S. Markley	George J. Bishop	Wm. S. Danes	R. L. Heflin.
	W. M. Noon	C. P. Austin	J. H. Markley	Frank W. Tanner.
	Joseph M. Staten	M. Riney	W. O. Eggleston	A. Zimmerman.

LIST OF OFFICERS OF THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS FROM ITS ORGANIZATION TO THE YEAR 1906-1907.

YEAR.	1899-1900.	1900-1901.	1901-1902.	1902-1903.
President	Aaron S. Markley	W. A. Rogers	W. S. Danes	B. F. Pickering.
First Vice-President	Walter A. Rogers	W. S. Danes	B. F. Pickering	C. O. Mallard.
Second Vice-President	Joseph M. Staten	B. F. Pickering	A. Shane	A. Shane.
Third Vice-President	Wm. S. Danes	A. Shane	A. Zimmerman	A. Zimmerman.
Fourth Vice-President	B. F. Pickering	A. Zimmerman	C. C. Mallard	A. Montzheimer.
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson.
Treasurer	N. W. Thompson.	N. W. Thompson	N. W. Thompson	N. W. Thompson.
Executive Members	T. M. Strain	T. M. Strain	A. Montzheimer	W. E. Smith.
	R. L. Heflin	H. D. Cleaveland	W. E. Smith	A. W. Merrick.
	F. W. Tanner	F. W. Tanner	A. W. Merrick	C. P. Austin.
	A. Zimmerman	A. Montzheimer	C. P. Austin	C. A. Lichty.
	H. D. Cleaveland	W. E. Smith	C. A. Lichty	W. O. Eggleston.
	A. Montzheimer	A. W. Merrick	W. O. Eggleston	J. H. Markley.

YEAR.	1903-1904.	1904-1905.	1905-1906.	1906-1907.
President	A. Montzheimer	C. A. Lichty	J. B. Sheldon	J. H. Markley
First Vice-President	A. Shane	J. B. Sheldon	J. H. Markley	R. H. Reid
Second Vice-President	C. A. Lichty	J. H. Markley	R. H. Reid	J. P. Canty
Third Vice-President	J. B. Sheldon	R. H. Reid	R. C. Sattley	H. Rettinghouse
Fourth Vice-President	J. H. Markley	R. C. Sattley	J. P. Canty	F. E. Schall
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	C. P. Austin	C. P. Austin	C. P. Austin	C. P. Austin
Executive Members	R. H. Reid	W. O. Eggleston	H. Rettinghouse	W. O. Eggleston
	W. O. Eggleston	A. E. Killam	A. E. Killam	A. E. Killam
	A. E. Killam	H. Rettinghouse	J. S. Lemond	J. S. Lemond
	R. C. Sattley	J. S. Lemond	C. W. Richey	C. W. Richey
	H. Rettinghouse.	W. H. Finley	H. H. Eggleston	H. H. Eggleston
	J. S. Lemond	C. W. Richey	F. E. Schall	B. J. Sweatt

SUBJECTS FOR REPORT AND DISCUSSION, AND COMMITTEES SELECTED AT EACH CONVENTION SINCE ORGANIZATION OF THE ASSOCIATION IN 1891.

FIRST CONVENTION, ST. LOUIS, MO., SEPTEMBER 25, 1891.

	Subjects.	Committees.
1.	Surface Cattle-Guards	Aaron S. Markley, J. B. Mitchell, W. R. Damon.
2.	Frame and Pile Trestles Complete, including Rerailer	H. M. Hall, W. A. McGonagle, G. W. McGehee.
3.	Framing and Protection of Howe Truss and Other Wooden Bridges against Fire and Decay	J. E. Johnson, G. W. Markley, J. H. Markley.
4.	Iron and Vitrified Pipe for Waterways under Railroad Embankments	James Stannard, J. O. Thorn, J. E. Wallace.
5.	Water-Tanks Complete, including Painting, Pumps, Pump and Coal Houses, Wells and Reservoirs	G. W. Turner, R. K. Ross, Q. McNab.
6.	Interlocking Signals	B. F. Bond, G. W. Hinman, James Demars.
7.	Depot Platforms, Complete	J. A. Nicholson, Adam McNab, C. B. Keller.
8.	Paints for Iron Structures	Geo. M. Reid, A. J. Kelley, H. A. Hanson.

SECOND CONVENTION, CINCINNATI, O., OCTOBER 18 AND 19, 1892.

	Subjects.	Committees.
1.	Discipline, and Benefits Derived, and Who are the Beneficiaries	Geo. W. Andrews, W. R. Damon, T. M. Strain, G. W. Turner.
2.	Turn-table, Best, with a View of Economy, and Durability, and Strength	G. W. Markley, H. F. Martin, James H. Travis, Charles Walker.
3.	Water Columns, Best, Cheapest, Simplest, and Most Durable	C. E. Fuller, A. S. Markley, H. N. Spaulding, E. L. Cary.
4.	Coaling Stations, including Storage Bins and for Coaling Engines	J. E. Wallace. C. W. Gooch, G. W. Hinman. J. H. Cummin.

5\.

Crawling of Rails, and its Effects on Structures......	Geo. M. Reid, L. K. Spafford, J. B. Mitchell, L. S. Isdell.

6\.

Guard-Rails on Bridges, Advantages and Disadvantages, and Best to be Adopted.........................	O. J. Travis, Q. McNab, J. F. Mock, J. M. Staten.

7\.

Platforms, Height and Distance from Rail and Mode of Construction.......................................	James Stannard, M. Walsh, N. M. Markley, Robert Ogle.

8\.

Best Bridge, Wood, Combination, or Iron, from 180 feet and upwards, and the Best Method of Reconstruction..	A. Shane, Walter Ransom, N. Potter, C. G. Worden.

9\.

Best Method of Elevating Track upon Bridges and Trestles.................	H. E. Gettys, S. F. Patterson, G. W. Hinman, P. A. Watson.

THIRD CONVENTION, PHILADELPHIA, PA., OCT. 17, 18, AND 19, 1893.

1\.

Depressed Cinder Pits and Other Kinds...............	W. G. Berg, Abel S. Markley, G. W. Andrews, C. E. Fuller.

2\.

Best Method of Bridge Inspection.....................	G. M. Reid, J. M. Staten, E. T. Wise, J. S. Berry.

3\.

Pumps and Boilers.......................................	G. W. Markley, G. W. Turner, J. B. Mitchell, J. R. Harvey.

4\.

Maintenance of Pile and Frame Trestle.........	W. A. McGonagle, J. H. Markley, Geo. C. Nutting, John Copeland.

5\.

The Best Scale Foundation.............................	O. J. Travis, Joseph Doll, C. E. Wadley, T. M. Strain.

FOURTH CONVENTION, KANSAS CITY, MO., OCT. 16, 17, AND 18, 1894.

1\.

Mechanical Action and Resultant Effects of Motive Power at High Speed on Bridges	G. W. Andrews, W. G. Berg, J. E. Greiner, E. H. R. Green.

2\.

Methods and Special Appliances for Building Temporary Trestles over Washouts and Burnouts......	R. M. Peck, G. J. Bishop, A. B. Manning, C. D. Bradley.

3\.

Strength of Various Kinds of Timber Used in Trestles and Bridges, Especially with Reference to Southern Yellow Pine, White Pine, Fir, and Oak...	W. G. Berg, J. H. Cummin, John Foreman, H. L. Fry.

4.

Best Method of Erecting Plate-Girder Bridges ..

H. M. Hall,
J. M. Staten,
G. W. Hinman,
J. N. Pullen.

5.

Best and Most Economical Railway Track Pile-Driver..

J. L. White,
A. C. Davis,
J. F. Mock,
James T. Carpenter.

6.

Sand Dryers, Elevators, and Methods of Supplying Sand to Engines, including Buildings...............

Aaron S. Markley,
H. A. Hanson,
A. J. Kelley,
J. O. Thorn.

7.

Span Limits for Different Classes of Iron Bridges, and Comparative Merits of Plate-Girders and Lattice-Bridges for Spans from 50 to 110 feet...........

W. A. McGonagle,
R. M. Peck,
W. M. Noon,
H. E. Gettys.

8.

Best Method of Spanning Openings too Large for Box Culverts, and in Embankments too Low for Arch Culverts..

James Stannard,
L. K. Spafford,
O. H. Andrews,
F. W. Tanner.

9.

Best End Construction for Trestle Adjoining Embankments..

G. M. Reid,
J. L. Soisson,
N. M. Markley,
R. J. Howell.

10.

Interlocking Signals..................................

J. H. Travis,
W. S. Danes,
R. L. Heflin,
J. A. Spangler.

11.

Pumps and Boilers....................................

John H. Markley,
O. J. Travis,
A. Shane,
G. W. Markley.

FIFTH CONVENTION, NEW ORLEANS, LA., OCTOBER 15 AND 16, 1895.

1.

How to Determine Size and Capacity of Openings for Waterways.......................................

Aaron S. Markley,
J. S. Berry,
C. C. Mallard,
J. L. White.

2.

Different Methods of Numbering Bridges. Should All Waterways be Numbered?......................

A. Shane,
W. O. Eggleston,
J. L. Slosson,
O. J. Travis.

3.

Drawbridge Ends, Methods of Locking; and under this head include Locking of Turn-tables...........

H. M. Hall,
James Stannard,
H. Middaugh,
C. C. Mallard.

4.

Protection of Trestles from Fire, including Methods of Construction.......................................

R. M. Peck,
T. H. Kelleher,
A. McNab,
W. M. Noon,
G. W. Hinman,
William Berry.

5.

Local Stations for Small Towns and Villages, giving Plans of Buildings and Platforms....................

J. H. Cummin,
N. M. Markley,
J. H. Markley,
C. G. Worden.

6.

Tanks, Size, Style, and Details of Construction, including Frost-proof protection to Tank and Pipes..

W. O. Eggleston,
W. M. Noon,
A. McNab,
N. W. Thompson.

7.

Shearing of Rivets in Plate-Girders and Cause Thereof........ J. M. Staten, R. L. Heflin, J. H. Travis, G. M. Reid.

8.

Best and Uniform System of Report Blanks for Bridge and Building Department........ G. J. Bishop, W. O. Eggleston, Onward Bates, M. Riney.

9.

Protection of Railroad Structures and Buildings from Fire........ R. M. Peck, L. K. Spafford, B. T. McIver.

10. Brought forward from 1894.

Mechanical Action and Resultant Effects of Motive Power at High Speed on Bridges........ G. W. Andrews, W. G. Berg, J. E. Greiner, E. H. R. Green.

11. Brought forward from 1894.

Best and Most Economical Railway Track Pile-Driver........ J. L. White, A. C. Davis, J. F. Mock, J. T. Carpenter, G. W. Hinman.

12. Brought forward from 1894.

Span Limits for Different Classes of Iron Bridges, and Comparative Merits of Plate-Girders and Lattice Bridges for Spans from 50 to 110 feet........ W. A. McGonagle, R. M. Peck, W. M. Noon, H. E. Gettys, G. J. Bishop, Onward Bates.

13. Brought forward from 1894.

Interlocking Signals........ J. H. Travis, W. S. Danes, R. L. Heflin, J. A. Spangler.

SIXTH CONVENTION, CHICAGO, ILL., OCTOBER 20, 21, AND 22, 1896.

1.

Methods of Heating Buildings where Three or More Stoves are Now Used........ J. H. Cummin, George W. Hinman, George W. Markley, Wm. Berry.

2.

The Most Suitable Material for Roofs of Buildings of All Kinds........ R. M. Peck, G. W. Turner, W. M. Noon, N. W. Thompson.

3.

Roundhouse Construction, including Smoke-jacks and Ventilators........ Geo. W. Andrews, O. J. Travis, W. O. Eggleston, James T. Carpenter.

4.

Care of Iron Bridges after Erection........ James H. Travis, T. M. Strain, H. M. Hall, Walter Rogers.

5.

How to Determine Size and Capacity of Openings for Waterways........ Walter G. Berg, Aaron S. Markley, Onward Bates, A. J. Kelley.

6.

Protection of Railroad Buildings and Other Structures from Fire..	W. A. McGonagle, M. M. Garvey, J. D. Hilderbrand, John Foreman.

7.

Designs for Ice-Houses.....................................	W. B. Yereance, C. M. Large, J. H. Markley, Geo. W. Ryan.

8.

Best End Construction for Trestles adjoining Embankments..	C. C. Mallard, W. S. Danes, R. L. Heflin, A. C. Olney.

9.

Bridge Warnings for Low Overhead Structures.....	W. E. Harwig, M. A. Martin, E. H. R. Green, Joseph Doll.

10.

Stock-yards and Stock-sheds, including all Details of Construction..................................	Geo. J. Bishop, W. R. Cannon, O. H. Andrews, James Brady.

11.

Floor System on Bridges, including Skew Bridges...	W. G. Guppy, C. P. Austin, C. W. Gooch, F. W. Tanner.

SEVENTH CONVENTION, DENVER, COL., OCTOBER 19, 20, AND 21, 1897.

1.

Pile-rings and Method of Protecting Pileheads in Driving..	G. W. Hinman, Wm. S. Danes, F. Eilers, E. F. Reynolds, Wm. Carmichael, C. M. Large.

2.

Cost and Manner of Putting in Pipe Culverts........	Walter A. Rogers, Frank W. Tanner, John H. Markley, A. H. King, B. F. Bond, O. H. Andrews.

3.

Best Floors for Shops and Roundhouses..............	A. W. Merrick, C. S. Thompson, Wm. O. Eggleston, M. F. Cahill, J. B. Pullen, James Gilbert.

4.

Roundhouse Smoke-jacks and Ventilation............	George W. Andrews, Wm. O. Eggleston. Aaron S. Markley, R. J. Howell, J. T. Carpenter, A. McNab.

5.

Cattleguards and Wingfences..........................	C. C. Mallard, C. S. Thompson, A. Zimmerman, L. H. Wheaton, O. W. Osborne, R. L. Heflin.

6.

Prevention of Fire in Railroad Buildings..............	John D. Isaacs, Wm. A. McGonagle, M. Riney, H. L. Fry, J. P. Snow, Wm. B. Yearance.

7.

Storage of Fuel, Oil, and Other Station Supplies at Way-stations..................................	Arthur Montzheimer, A. Shane, G. E. Hauks, J. E. Johnson, W. Z. Taylor, E. M. Gilchrist.

8.

Railroad Highway Crossing Gates.....................	Joseph H. Cummin. J. B. Sheldon, Wm. E. Harwig, G. W. Smith, J. E. Featherston, W. M. Noon.

9.

What Repairs, and How Can they be Safely Made, to Metal and Wooden Spans Without the Use of False-work	F. S. Edinger, B. W. Guppy, J. E. Greiner, John D. Isaacs, Walter A. Rogers, H. W. Fletcher.

10.

Care of Iron Bridges After Erection, including Best Method of Protecting Them From Injury by Salt Water Drippings from Refrigerator cars...........	J. E. Greiner, B. W. Guppy, James McIntyre, T. M. Strain, A. J. Kelley, L. F. Goodale.

11.

Turntable Construction......................	Onward Bates, J. B. Sheldon, D. K. Colburn, John Foreman, E. Fisher, Henry Goldmark.

EIGHTH CONVENTION, RICHMOND, VA., OCTOBER 18 AND 19, 1898.

1.

What is the Most Economical Method of Painting Railway Bridges and Buildings, and Best Material to use	A. Montzheimer, B. F. Pickering, H. D. Cleaveland, W. A. McGonagle.

2.

Life of Different Kinds of Timber in Bridges of Various Kinds, and Advisability of Protecting Same from the Weather..	B. W. Guppy.

3.

The Best Method of Constructing and Maintaining Highway and Farm Crossings........................	J. H. Markley, W. O. Eggleston, T. M. Strain, O. J. Travis.

4.

Best Practical Sanitary Arrangement for Local Stations where there are no Water or Sewer Systems.	W. A. Rogers, J. B. Sheldon, C. H. Miller, J. McIntyre.

5.

Best and Most Economical Plant for Pumping Water for Water Stations...........................	A. Shane, A. S. Markley, R. L. Heflin, W. E. Smith.

6.

Necessary and Kind of Tools for the Proper Equipment of a Gang of Bridge Men.	G. J. Bishop, G. W. Hinman, M. Riney, A. Zimmerman.

7.

Best Snow Fence—Stationary and Portable	A. W. Merick, A. E. Killam, J. D. Isaacs. A. H. King.

8. Brought forward from 1897.

What Repairs and How Can They Be Safely Made to Metal and Wood Spans Without the Use of False Work	F. S. Edinger, J. E. Greiner, J. D. Isaacs, W. A. Rogers, H. W. Fletcher.

9. Bronght forward from 1897.

Prevention of Fire in Railroad Buildings..............	G. W. Andrews, A. D. Schindler, W. E. Smith, S. B. Rice.

NINTH CONVENTION, DETROIT, MICH., OCTOBER 17 AND 18, 1899.

1. Brought forward from 1898.

Necessary and Kind of Tools for the Equipment of a Gang of Bridge Men..................................	W. S. Danes, J. M. Staten, W. O. Eggleston, J. M. Caldwell.

2. Brought forward from 1898.

Best Snow Fence, Stationary or Portable.............	W. E. Smith, A. McNab, Geo. E. Hanks, A. W. Merrick. W. M. Noon.

3.

Best Method of Erecting Track Scales, Suspended or under Track........	H. D. Cleveland, Wm. M. Clark, O. P. Austin, J. T. McIlwaine.

4.

Is Concrete the Most Suitable and Economical Material for Bridge Piers and Abutments and Railway Culverts and Arches ?.................................	W. A. Rogers.

5.

Hand *vs*. Air-riveting Power Used. Actual Cost Compared with Hand Work in the Field for the Erection of New Work and Repairing; also Drilling for Reinforcing old Spans.......................	A. B. Manning, A. Shane, Geo. J Bishop, O. J. Travis, F. W. Tanner, F. S. Edinger.

6.

Most Practical and Cheapest Bumper for Yard Terminals..	B. F. Pickering, A. A. Page, W. E. Harwig, A. E. Killam.

7.

Are Tie Plates on Bridge Ties a Benefit or a Detriment ?..	C. A. Lichty, A. Montzheimer, C. W. Vandergrift, H. W. Fletcher, F. S. Edinger, J. B. Sheldon.

TENTH CONVENTION, ST. LOUIS, MO., OCT. 16, 17, AND 18, 1900.

1.	Methods of Sinking Foundations for Bridge Piers in Depth of Water Twenty Feet and Under...........	G. W. Andrews, C. C. Mallard, C. A. Lichty, C. W. Gooch, C. S. Thompson, D. Robertson.
2.	Passenger Platforms at Way Stations, Best Material and Cost of Same.....................	J. B. Sheldon, John I. Banks, N. H. LaFountain, L. H. Wheaton, Wm. A. Fort, A. McNab.
3	Slips for Ferry Boats Used for Transferring Railway Cars................................	John D. Isaacs, H. D. Cleaveland, J. H. Cummin, Charles Carr, H. Rettinghouse, J. T. Carpenter
4.	Best Method of Operating Turn-tables by Power....	F. E. Schall, J. E. Greiner, B. F. Pickering, Onward Bates.
5.	Auxiliary Coaling Stations; Best Design, Capacity, and Method of Handling Coal........................	W. A. McGonagle, G. W. Smith E. Fisher, J. P. Snow, B. F. Bond, R. B. Tweedy.
6.	Water Stations; Best Material for Foundations, Tanks, Substructure, Connections, Capacity, etc...	A. S. Markley, Charles Carr, W. O. Eggleston, A. J. Austin A. Shane.
7.	Is it Best for Railroad Companies to Erect Their Own Steel Structures, or Let the Manufacturers Erect Them?.. ...	O. J. Travis, F. S. Edinger, A. B. Manning, James McIntyre, A. Zimmerman.
8.	The Best and Most Convenient Outfit Cars for Bridge Gangs, and Number of Men Constituting a Bridge Gang..	A. W. Merrick, S. S. Millener, Wm. M. Clark, A. A. Page, M. F. Cahill, W. E. Harwig, G. O. Lilly.

ELEVENTH CONVENTION, ATLANTA, GA., OCT. 15, 16, AND 17, 1901.

1.

Auxiliary Coaling Stations; Best Designs, Capacity, and Method of Handling Coal. Brought forward from 1900	W. A. McGonagle, G. W. Smith, E. Fisher, J. P. Snow, B. F. Bond, R. B. Tweedy.

2.

Roof Coverings, First Cost, Life, Efficiency, and Maintenance Expenses for Various Classes of Railroad Buildings	E. Fisher, R. H. Reed, J. S. Berry, J. P. Snow.

3.

Mail Cranes, First Cost, Efficiency and Maintenance of Various Styles in Use	A. S. Markley, F. Price, James Brady, G. W. Smith. D. W. Lum.

4.

Best Method of Protecting Low Overhead Structures Over Tracks from Gases and Blast of Locomotives.	G. W. Andrews, J. S. Lemond, C. M. Large, A. H. King, James T. Carpenter, E. H. R. Green, A. E. Killam.

5.

What has been the Experience in the Use of Concrete Under Bridge Bedplates and Turn-tables in Place of Pedestal Stones, and What is the Best Form and Material for Bedplates Under Various Styles of Iron Bridges?	W. A. Rogers, Frank W. Tanner, George J. Bishop, J. H. Markley, A. McNab, George E. Hanks.

6.

Best Design and Recent Practice in Building Railroad Track Pile Driver	T. M. Strain, A. W. Merrick, Chas. C. Mallard, A. B. Manning, W. M. Noon, W. T. Powell.

7.

Best Material and Designs for Roundhouse Pits, Including Drainage and Rail Fastings	ArthurMontzheimer, E. M. Gilchrist, J. W. Taylor, James Stannard, Onward Bates.

8.

Best Materials for Wearing Surface of Roadway of Highway Bridge Floors	W. O. Eggleston, B. F. Peckering, A. B. Sheldon, C. P. Austin, Joseph M. Staten, O. J. Travis.

TWELFTH CONVENTION, MINNEAPOLIS, MINN., OCT. 21 TO 23, 1902.

1.	
Best False Work for Rocky Bottom in Rapid Currents Where Piles Cannot be Driven.................	John P. Canty, H. H. Eggleston, O. D. Killebrew, F. F. Lloyd, A. C. Macy, J. E. Greiner.
2.	
Should Ties of Bridges be Gained so as to Leave Rail Without Camber, or Should Only a Portion of Camber Be Taken Out?............................	R. H. Reid, Onward Bates, H. D. Cleaveland, Henry Goldmark, J. E. Johnson, G. W. McGehee.
3.	
In Case One Arm of an Important Metal Drawbridge Over a Deep Stream Should be Wrecked, What is the Most Expeditious Way to Restore Railway and Water Traffic?..	John D. Isaacs, F. E. Schall, Geo. C. Nutting, W. M. Noon, A. McNab, Geo. W. Andrews.
4.	
What is the Best Form of Traveler to Use in Erecting Steel Railway Bridges of Spans up to Two Hundred Feet?..	G. W. Smith, O. J. Travis, J. P. Snow, C. W. Kelley, Joseph M. Staten, F. W. Tanner.
5	
Best Method of Protecting Solid Steel Floors of Bridges..	A. O. Cunningham, Geo. F. Powers, D. W. Lum, Albert C. Keith, C. P. Austin, F. E. Schall.
6.	
Best Plans for Small Tool Houses, Including Switchmen's and Car Repairers' Shanties, and Section, Tool, and Hand-car Houses.........................	J. B. Sheldon, H. E. Holmes, W. E. Bell, Geo. Mitchell, Ed. Gagnon, C. R. Walton.
7.	
Best Practical Sanitary Arrangements for Small Stations Where There Are no Water or Sewer Systems	J. H. Markley, F. J. Leavitt, Geo. J. Patterson, E. B. Ashby, T. J. Darracott, A. W. Merrick.
8.	
Best Method of Making Annual Inspection of Bridges and Culverts, and Form of Report to be Made......	Walter G. Berg, J. A. Dodson, C. F. Loweth, Arthur Montzheimer, A. Zimmerman, A. Shane. I. O. Walker.
9.	
Water Filters, or Other Methods of Purifying Water for Engine Use.....................	R. C. Sattley, J. E. Greiner, Ed. M. Gilchrist, Geo. E. Hanks, A. B. Manning, James Rogers.

10.

Best Method of Storing Fuel Oil, With Appliances for Supplying Locomotives, Including Plan of Water Stations, Showing Relative Arrangements of Fuel and Water Supply..............................	C. C. Mallard, J. S. Berry, Geo. J. Bishop, William Carmichael, W. M. Clark, I. W. Evans, E. Fisher.

11.

What Has Been the Experience in the Use of Concrete Under Bridge Bed-plates and Turn-tables in Place of Pedestal Stones, and What is the Best Form and Material for Bed-plates Under Various Styles of Iron Bridges.........	Walter A. Rogers, A. Minster, L. F. Goodale, E. H. R. Green, J. C. Hain, E. P Hawkins.

THIRTEENTH CONVENTION, QUEBEC, CANADA, OCT. 20 TO 22, 1903

1.

What is the Best Form of Traveler to Use in Erecting Steel Railway Bridges of Spans up to 200 Feet..	G. W. Smith, Moses Burpee, Geo. J. Bishop, A. O. Cunningham, J. C. Hain, I. F. Stern.

2.

What Has Been the Experience in Use of Concrete Under Bridge Bed-plates and Turn-tables in Place of Pedestal Stones, and What is the Best Form and Material for Bed-plates Under Various Styles of Iron Bridges (Continued from 1902)..................	C. F. Loweth, T. M. Strain, J. E. Johnson, A. Minster, D. W. Lum, J. P. Snow.

3.

Best Methods of Caring for Trestles While Being Filled....	A. H. King, J. B. Sheldon, H. D. Cleaveland, A. J. Hart, F. Ingalls, J. S. Lemond.

4.

Best Forms of Construction for Engine Houses.	A. W. Merrick, L. H. Wheaton, R. L. Heflin, C. W. Kelley, C. C. Mallard, A. B. Manning.

5.

Best Methods of Filling Ice Houses and Conveying Ice to Refrigerator Cars..............................	J. T. Carpenter, F. L. Burrell, John P. Canty, A. McNab, C. M. Large, G. Larson.

6.

Best Methods of Filling Track Water Tanks Automatically..	E. B. Ashby, Willard Beaham, C. H. Miller, Thomas S. Leake, F. E. Schall, L. F. Price.

7.

Steam Hammers Versus Drop Hammers for Pile-drivers	O. J. Travis, R. H. Reid, N. H. LaFountain, Frank J. Leavitt, G. O. Lilly, H. Bettinghouse.

8.

Best Form of Construction for Docks and Wharves	John D. Isaacs, W. A. McGonagle, Henry Goldmark, G. J. Klump, R. B. Tweedy, G. F. Powers.

9.

Best Record Forms for Buildings, Water Tanks, etc.	B. J. Sweatt, B. F. Pickering, A. Shane, I. O. Walker, J. F. White, William E. Harwig.

10.

Best Freight and Roundhouse Doors, and Fittings for the Same	John I. Banks, James McIntyre, R. K. Ross, Ed. Gilchrist, George W. Welker.

11.

Best Methods for Preserving Timber and Piles in Structures	Wm. F. Steffens, John D. Isaacs, Geo. A. Mountain, E. Loughery, C. C. Witt, B. F. Bond.

12.

Best Methods of Protecting Low Overhead Structures Over Tracks from Gases and Blast of Locomotives	B. W. Guppy, Grosvenor Aldrich, F. F. Lloyd, Robert J. Bruce, Wm. M. Clark, J. S. Berry.

FOURTEENTH CONVENTION, CHICAGO, ILL., OCTOBER 18 TO 20, 1904.

1.

Construction and Maintenance of Docks and Wharves.	H. Rettinghouse, W. A. McGonagle, A. A. Page, J. S. Browne. W. M. Noon, L. J. Anderson, L. D. Smith.

2.

Relative Value of Concrete and Timber Piles...........	W. H. Finley, J. C. Hain, W. A. Rogers, D. W. Lum, W. S. Dawley, L. F. Goodale.

3.

Concrete Building Construction, Including Platforms.	C. W. Richey, A. O. Cunningham, C. F. Loweth, G. A. Wright, F. P. Gutelius.

4.

Anchors for Plows and Derricks	R. J. Arey, A. J. Ross, E. Loughery, M. Bishop.

5.

Methods of Repairing Roofs of Various Kinds..........	J. N. Penwell, A. W. Merrick, G. C. Larson, H. W. Phillips, O. F. Flint, Floyd Ingram.

6.

Methods of Watering Stock in Transit..................	J. O. Thorn, B. J. Sweatt, F. O. Draper, F. Ingalls, F. L. Park.

7.

Protection of Water Tanks and Water Pipes from Action of Frost..	J. P. Canty, J. Parks, A. Findley, F. L. Burrell, K. J. C. Zinck.

8.

Recent Practice in Coffer Dam Work....................	W. F. Steffens, F. E. Schall, G. J. Klumpp, R. H. Reid, Wm. Kleefeld, Jr.

STANDING COMMITTEES.—FOURTEENTH CONVENTION.

1.

Pile and Frame Trestle Bridges	F. S. Edinger. W. M. Clark, I. F. Stern, W. E. Alexander, J. C. Taylor.

2.

Steel Bridges	H. H. Eggleston, J. P. Snow, C. H. Cartlidge, H. M. Trippe, J. W. Lantry.

3.

Buildings	E. Du Bois Brown, W. A. Pettis, W. C. Halsey, T. S. Leake.

4.

Docks and Wharves	R. Angst, W. J. Mellor, John I. Banks, K. S. Hull, A. McDonald.

5.

Water Supply	B. M. Hudson, F. J. Leavitt, D. C. Zook, Charles Carr, J. H. Howe.

6.

Fire Protection	Geo. W. Andrews, R. A. Nickerson, Wm. H. Keen, H. A. Horning.

7.

Fences, Crossings and Cattle Guards	C. S. Corrigan, C. F. King, J. S. Berry, Walter Hurst, Burton Marye.

8.

Preservatives for Wood and Metals	F. D. Beal, J. F. Parker, E. Fisher, J. C. Beye, C. A. Thanheiser.

9.

Coaling Stations and Cinder Pits	W. B. Causey, R. M. Drake, J. W. McCormack, Willard Beaham.

10.

Records and Accounts	H. M. Henson, R. C. Sattley, Ed. Gagnon, E. R. Floren.

FIFTEENTH CONVENTION, PITTSBURG, PA., OCTOBER 17 TO 19, 1905.

1.

Concrete Bridges, Arches and Subways	N. H. LaFountain, R. H. Reid, G. E. Hanks, A. S. Markley, H. D. Cleaveland, M. Burpee.

2.

Experience and Use of Concrete and Timber Piles	W. H. Finley, E. N. Layfield, W. S. Dawley, L. D. Smith.

3.

Concrete Building Construction	C. W. Richey, W. W. Perry, Charles Carr, R. P. Mills, W. B. Yearance, R. L. Heflin.

4.

Method of Watering Stock in Transit	J. N. Penwell, U. A. Horn, M. R. Williams, C. F. King, G. F. Powers, J. C. Taylor.

5.

Recent Practice in Coffer Dam Work	W. F. Steffens, G. Aldrich, W. A. Fort, E. P. Hawkins.

6.

Modern Coaling Stations and Cinder Pits	J. S. Browne, F. B. Scheetz, D. W. Lum, G. H. Soles, F. P. Gutelius.

7.

Bumping Blocks for Passenger and Freight Use	A. E. Killam, Thos. S. Leake, F. L. Burrell, J. M. Staten, A. B. Hubbard.

COMMITTEES ON STANDING SUBJECTS.—FIFTEENTH CONVENTION.

1.

Pile and Frame Trestle Bridges	J. P. Canty, K. S. Hull, J. E. Johnson, W. O. Eggleston, H. F. Morrill.

2.

Steel Bridges	A. O. Cunningham, W. H. Wilkinson, J. P. Snow, W. M. Kleefeld, F. E. Schall.

3.

Buildings	W. B. Causey, F. Ingram, Walter Hurst, J. M. Caldwell.

4.

Water Supply	B. M. Hudson, H. Rettinghouse, M. Riney, J. L. Talbott, M. Bishop.

5.

Fire Protection	Geo. W. Andrews, R. A. Nickerson, W. H. Keene, D. C. Zook.

6.

Fences, Road Crossings and Cattle Guards	A. Findley, J. Hartley, A. McDonald, Geo. J. Patterson, M. P. Tucker.

7.

Preservatives for Wood and Metals	F. D. Beal, R. J. Arey, H. Small, W. A. McGonagle.

8.

Records and Accounts	R. C. Sattley, J. S. Lemond, James Stannard, J. C. Beye.

SIXTEENTH CONVENTION, BOSTON, MASS., OCTOBER 16 TO 18, 1906.

1.

Experience in Concrete Bridges, Arches and Subways	W. H. Finley, McClellan Bishop, W. B. Causey, R. C. Sattley.

2.

Concrete Building Construction	A. O. Cunningham, B. R. Leffler, T. J. Fullem, M. Riney.

3.

Experience as to Expansion and Contraction of Concrete Walls, either Reinforced or Plain Concrete	A. S. Markley, W. A. Rogers, R. H. Reid, P. J. O'Neil.

4.

Action of Sea Water on Concrete. A. Concrete Made in Air and Sunk into Sea Water. B. Concrete Deposited direct into Sea Water	Grosvenor Aldrich, Willard A. Pettis, George W. Andrews, John E. Barrett.

5.

Recent Experience in the Use of Wooden and Asbestos Smoke Jacks for Engine Houses	J. H. Cummin, M. J. Flynn, A. F. Miller, D. L. McKee.

6.

Combination Fastenings and Locks for Rolling and Sliding Doors on Freight Houses and other Buildings	C. A. Lichty, H. Rettinghouse, John L. Talbott, W. T. Powell.

7.

Construction of Towers and Guides for Lights on Drawbridges	John N. Penwell, Floyd Ingram, George W. Rear, G. J. Klumpp.

8.

Recent Experience in Protecting Steel Railroad Bridges against the Action of Salt Brine from Refrigerator Cars	R. P. Mills, A. Montzheimer, Walter G. Berg, F. O. Draper, Charles Carr.

COMMITTEES ON STANDING SUBJECTS.—SIXTEENTH CONVENTION.

1.

Pile and Frame Trestle Bridges........................	W. E. Smith, J. S. Berry, John O. Beye, E. R. Floren.

2.

Water Supply....................	C. E. Thomas, J. M. Caldwell, B. F. Bond. A. C. Blake.

3.

Fire Protection..	Wm. C. Carmichael, D. A. Shope, A. Shane, S. F. Clapp.

4.

Fences, Road Crossings and Cattle Guards...........	W. M. Noon, A. McNab, W. A. Fort, F. W. Tanner.

5.

Preservatives for Wood and Metals..................	J. F. Parker, R. J. Arey. James Fraser, J. S. Lemond, R. J. Bruce.

CONSTITUTION.

ARTICLE I.

NAME.

SECTION 1. This Association is known as the "Association of Railway Superintendents of Bridges and Buildings."

ARTICLE II.

OBJECT.

SECTION 1. The object of this Association shall be the mutual advancement of its members, by the acquirement of more perfect knowledge in the construction, maintenance, and repair of railroad bridges and buildings, as well as all other matters entrusted to the care of superintendents of bridges and buildings, by common discussion, interchange of ideas, reports, and investigations of its members.

ARTICLE III.

MEMBERSHIP.

SECTION 1. Any person at the head of a bridge and building department on any railroad, or a division or subdivision, and to include assistant superintendent and general foreman of any railroad, shall be eligible to membership in this Association upon application to the secretary and the payment of $3.00 membership fee and $2.00 for one year's dues, membership to continue until written resignation is received by the secretary, unless member has been previously expelled.

SEC. 2. Any member guilty of dishonorable conduct, or conduct unbecoming a railroad official and member of this Association, or who shall refuse to obey the chairman, or rules of this Association, may be expelled by a two-thirds vote of the members present.

SEC. 3. Any member elected a Life Member of this Association, shall have all of the privileges of an active member, but shall not be required to pay annual dues.

ARTICLE IV.

OFFICERS.

SECTION 1. The officers of this Association shall be a president, four vice-presidents, a secretary, a treasurer, and six executive members. The executive members, together with the president, secretary, and treasurer, shall constitute the Executive Committee.

All Past-Presidents of this Association, who continue to be members, shall be entitled to be present at all meetings of the Executive Committee, of which meetings they shall receive due notice, and be permitted to discuss all questions coming before the Executive Committee and to aid said committee by their advice and counsel; but, said Past-Presidents shall not have a right to vote, nor shall their presence be requisite in order to constitute a quorum.

ARTICLE V.

DUTIES OF OFFICERS.

SECTION 1. The duties of officers shall be such as prescribed by by-laws, as pertain to officers of like character, general, or may be assigned them by the Executive Committee.

ARTICLE VI.

EXECUTIVE COMMITTEE.

SECTION 1. The Executive Committee shall exercise a general supervision over the financial and other interests of the Association, assess the amount of annual and other dues, call, prepare for, and conduct general or special meetings, make all necessary purchases and contracts required to conduct the general business of the Association, but shall not have power to render the Association liable for any debt beyond the amount then in the treasurer's hands not subject to other prior liabilities. All appropriations for special purposes must be acted upon at a regular meeting of the Association.

SEC. 2. The Executive Committee shall report the proceedings of its meetings, making such reports accessible to members; it shall publish the proceedings of all meetings of the Association, subject to the approval of the Association.

SEC. 3. Two-thirds of the members of the Executive Committee may call special meetings, sixty days' notice being given members by mail.

SEC. 4. Five members of the Executive Committee shall constitute a quorum for the transaction of business.

ARTICLE VII.

ELECTION OF OFFICERS AND TENURE OF OFFICE.

SECTION 1. The officers, excepting as otherwise provided, shall be elected at the regular meeting of the Association, held on third Tuesday in October of each year, and the election shall not be postponed except by unanimous consent.

PRESIDENT AND TREASURER.

SEC. 2. The president and treasurer shall be elected by ballot by a majority of votes cast, and shall hold office for one year, or until successors are elected.

VICE-PRESIDENTS AND EXECUTIVE MEMBERS.

SEC. 3. The vice-presidents shall hold office for one year and executive members for two years, four vice-presidents, and three executive members to be elected each year; provided, however, that three of the executive members be appointed by the president at the adoption of this constitution. All officers herein named to hold office until successors are chosen at next annual meeting.

SEC. 4. In the election of vice-presidents, each one shall be elected by a majority vote. Executive members will be elected in the same way, all voting to be by written ballots.

SECRETARY.

SEC. 5. A secretary shall be elected by a majority of the votes of the members present at the annual meeting. The term of office of the secretary shall be for one year, unless terminated sooner by action of the Executive Committee, two-thirds of whom may remove the secretary at any time. His compensation shall be fixed by a majority of the Executive Committee. The secretary shall also be secretary of the Executive Committee.

TREASURER.

SEC. 6. The treasurer shall be required to give bond in an amount to be fixed by the majority of the Executive Committee.

ARTICLE VIII.

COMMITTEES.

SECTION 1. At the first session of the annual meeting the president shall appoint a committee of three members, not then officers of the Association, who shall send names of nominees for officers of the Association for the ensuing year to the secretary, before the election of officers is in order, and the names shall be announced as soon as received. The election shall not be held until the day after announcement, except by unanimous consent. Nothing in this section shall be construed to prevent any members from making nominations.

AUDITING COMMITTEE.

SEC. 2. At the first session of each annual meeting there shall be appointed by the president an auditing committee of three members, not officers of the Association, whose duty it shall be to examine the accounts and vouchers of the treasurer and certify as to the correctness of his accounts. Acceptance of this committee's report will be regarded as the discharge of the committee.

COMMITTEES ON SUBJECTS FOR DISCUSSION.

SEC. 3. At the annual meeting there shall be appointed by the president a committee, whose duty it shall be to prepare and report subjects for discussion and investigation at the next annual meeting. If subjects are approved by the Association, the presi-

dent shall appoint a committee to report on them. It shall be the duty of the committee to receive from members questions for discussion during the time set apart for that purpose. This committee shall be the judge of whether such questions are suitable ones for discussion, and if so, report them to the Association.

COMMITTEES ON INVESTIGATION.

SEC. 4. When the committee on subjects has reported and the Association approved of the same, the president shall appoint special committees to investigate and report on said subjects and he may appoint a special committee to investigate and report on any subject which a majority of members present may approve of.

ARTICLE IX.

ANNUAL DUES.

SECTION 1. Every member shall pay to the treasurer three dollars membership fee, and shall also pay two dollars per year in advance to defray the necessary expenses of the Association. No member being one year in arrears for dues will be entitled to vote at any election, and any member one year in arrears may be stricken from the list of members at the discretion of the Executive Committee.

ARTICLE X.

AMENDMENTS.

SECTION 1. This constitution may be amended at any regular meeting by a two-thirds vote of members present, provided that a written notice of the proposed amendment has been given at least ninety days previous to said regular meeting.

BY-LAWS.

TIME OF MEETING.

1. The regular meeting of this Association shall be held annually on the third Tuesday in October.

HOUR OF MEETING.

2. The regular hour of meeting shall be at 10 o'clock a. m.

PLACE OF MEETING.

3. The cities or places for holding the annual convention may be proposed at any regular meeting of the Association before the final adjournment. The places proposed shall be submitted to a ballot vote of the members of the Association, the city or place receiving a majority of all the votes cast to be declared the place of the next annual meeting; but if no place received a majority of all votes, then the place receiving the lowest number of votes shall be dropped on each subsequent ballot until a place is chosen.

QUORUM.

4. At the regular meeting of the Association, fifteen or more members shall constitute a quorum.

ORDER OF BUSINESS.

5. 1st—Calling of roll.
2d—Reading minutes of last meeting.
3d—Admission of new members.
4th—President's address.
5th—Reports of secretary and treasurer.
6th—Payment of annual dues.
7th—Appointment of committees.
8th—Reports of committees.
9th—Unfinished business.
10th—New business.
11th—Reading and discussion of questions propounded by members.
12th—Miscellaneous business.
13th—Election of officers.
14th—Adjournment.

DUTIES OF OFFICERS.

6. It shall be the duty of the president to call the meeting to order at the appointed time; to preside at all meetings; to announce the business before the Association, and to decide all questions of order and sign all orders drawn on the treasurer.

7. It shall be the duty of the vice-presidents, in the absence of the president, to preside at all meetings of the Association, in their order named.

8. It shall be the duty of the secretary to keep a correct record of proceedings of all meetings of this Association; to keep correct all accounts between this Association and its members; collect all moneys due the Association, and pay the same over to the treasurer and take his receipt therefor, and to perform such other duties as the Association may require.

9. It shall be the duty of the treasurer to receive and receipt to the secretary for all moneys received from him, and pay all orders authorized by the Association.

DECISIONS.

10. The votes of a majority of members present shall decide any question, motion, or resolution which shall be brought before the Association, unless otherwise provided.

DISCUSSIONS.

11. All discussions shall be governed by Roberts' Rules of Order.

DIRECTORY OF MEMBERS.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.

OCTOBER, 1906.

A

ALDRICH, GROSVENOR, N. Y., N. H. & H. R. R., Readville, Mass.

ALEXANDER, W. E., Bangor & Aroostook Railroad, Houlton, Me.

AMOS, ALEXANDER, Minn., St. P. & S. Ste. M. Ry., Minneapolis, Minn.

ANDERSON, J. W., Cin., Hamilton & Dayton Ry., Chillicothe, Ohio.

ANDERSON, L. J., C. & N. W. Ry., Escanaba, Mich.

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WHITE, I. F., Div. Engr. C., H. & D. Ry., Dayton, O.

WHITE, I. H., H. & S. W. Ry., Bridgewater, N. S.

WILKINSON, JOHN M., Cin. Northern R. R., 702 N. Washington St., Van Wert, O.

WILKINSON, W. H., Bridge Insp., Erie R. R., 464 Lyon St., Elmira, N. Y.

WILLIAMS, ARTHUR, Engr., Wellington & Manawata Ry., Wellington, N. Z.

WILLIAMS, M. R., A., T. & S. F. Ry., Las Vegas, N. M.

WILSON, E. E., N. Y. C. & H. R. R. R., 138th St., Mott Haven, N. Y. City.

WINTER, A. E., Div. Engr., C. & N. W. Ry., Escanaba, Mich.

WITT, C. C., C. & N. W. Ry., Chicago, Ill.

WRIGHT, G. A., C. & E. I. R. R., Danville, Ill.

Y

YAGER, LOUIS, Nor. Pac. Ry., Minneapolis, Minn.

YAPPEN, ADOLPH, C., M. & St. P. Ry., Chicago, Ill.

YERANCE, WM. B., C. E., 418 Center St., South Orange, N. J.

Z

ZINOK, K. J. C., Asst. to Chief Engr., G. T. Bldg., Montreal.

ZINSMEISTER, E. C., B. & O. R. R., Zanesville, O.

ZOOK, D. C., Penn. Lines West of Pittsburg, Ft. Wayne, Ind.

LIFE MEMBERS.

CRANE, HENRY, C. & N. W. Ry., Janesville, Wis.
FLETCHER, HOLLAND W., 1813 Termon Ave., Allegheny, Pa.
FOREMAN, JOHN, Phila & Read. R. R., Pottstown, Pa.
GREEN, E. H. R., Tex. Mid. R. R., Terrell, Tex.
McINTYRE, JAMES, Miami, Fla.
SCHWARTZ, JOHN C., C., St. P., M. & O. Ry., Emerson, Neb.
WALDEN, W. D., C. & N. W. Ry., Clinton, Ia.
WISE, E. F., Ill. Cent. R. R., Waterloo, Ia.

DECEASED MEMBERS.

BRADY, JAMES, C., R. I. & P. Ry., Davenport, Ia.
DEMARS, JAMES, Wheeling & L. Erie R. R., Norwalk, Ohio.
DUNLAP, H., Wabash R. R., Andrews, Ind.
FULLER, C. E., T. H. & I. R. R., Terre Haute, Ind.
GRAHAM, T. B., Nor. Pac. Ry., Little Falls, Minn.
HINMAN, G. W., Louisville & Nashville R. R., Evansville, Ind.
ISADELL, L. S., O. & M. R. R., Lawrenceburg, Ind.
LOVETT, J. W., Southern Ry., Atlanta, Ga.
MARKLEY, ABEL S., Pittsburg & Western Ry. Co., Allegheny, Pa.
McGEHEE, G. W., Mobile & Ohio R. R., Okolona, Miss.
MILLINER, S. S., B. & O. S. W. Ry., Washington, Ind.
MITCHELL, J. B., C., C., C. & St. L. Ry., Indianapolis, Ind.
MITCHELL, W. B., N. Y., P. & O. R. R., Galion, Ohio.
MORGAN, T. H., Gulf, Col. & S. F. Ry, Cleburne, Tex.
PECK, R. M., Missouri Pac. & St. L., I. M. & S. Ry., Pacific, Mo.
REID, GEORGE M., L. S. & M. S. Ry., Cleveland, Ohio.
*SCHWARTZ, JOHN C., C., St. P., M. & O. Ry., Emerson, Neb.
SPAFFORD, L. K., K. City, Fort Scott & Memphis Ry., Kansas City, Mo.
SPANGLER, J. A., B. & O. Ry., Washington, Pa.
TAYLOR, J. W., Terminal R. R. Association of St. Louis, St. Louis, Mo.
THOMPSON, N. W., P., F. W. & C. Ry., Ft. Wayne, Ind.
TOZZER, WILLIAM S., C. & O. R. R., Cincinnati, Ohio.
TRAUTMAN, J. J., S. C. R. R., Edgefield, S. C.
WORDEN, C. G., S. F. Pac. R. R., Winslow, Ariz.

* Information of his death received after convention adjourned.

MEMBERSHIP AND MILEAGE OF RAILWAYS REPRESENTED IN THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.

Name of Road and Membership.	Members.	Mileage.
Arizona & Colorado R. R.	1	17
J. W. Reagan, Farmington, N. M.		
Atchison, Topeka & Santa Fé Railway	6	5,043
F. M. Clough, San Marcial, N. M.		
J. D. Gilbert, Topeka, Kan.		
E. A. McCann, Wellington, Kan.		
John L. Talbot, Pueblo, Col.		
J. M. Wells, Chillicothe, Ill.		
M. R. Williams, Las Vegas, N. M.		
Atchison, Topeka & Santa Fé Railway (Coast Lines)	4	1,980
R. J. Arey, Williams, Ariz.		
E. E. Ball, Williams, Ariz.		
J. F. Parker, San Bernardino, Cal.		
D. A. Shope, Winslow, Ariz.		
Atlanta & West Point Railroad, and Western Railway of Alabama	1	225
O. T. Nelson, Montgomery, Ala.		
Atlantic Coast Line (Plant System) Railroad	1	4,085
W. E. Bell, Thomasville, Ga.		
Baltimore & Ohio Railroad	8	3,446
G. W. Andrews, Baltimore, Md.		
W. M. Clark, Warren, O.		
William Graham, Baltimore, Md.		
J. E. Greiner, Baltimore, Md.		
W. T. Hopke, Grafton, W. Va.		
J. T. McIlwain, Akron, O.		
Willam Renton, Garrett, Ind.		
E. C. Zinsmeister, Zanesville, O.		

	Members.	Mileage.
Bangor & Aroostook Railroad	3	469
W. E. Alexander, Houlton, Me.		
M. Burpee, Houlton, Me.		
R. D. Coombs, Houlton, Me.		
Barclay Railroad	1	14
C. H. Davis, New York City.		
Bessemer & Lake Erie Railroad	1	216
H. D. Cleaveland, Greenville, Pa.		
Boston & Maine Railroad	14	2,287
Cyrus P. Austin, Medford, Mass.		
C. C. Battey, Concord, N. H.		
J. P. Canty, Fitchburg, Mass.		
Andrew B. Hubbard, Boston, Mass.		
F. J. Leavitt, Sanbornville, N. H.		
William A. Lydston, Salem, Mass.		
Albert Mountfort, Nashua, N. H.		
A. A. Page, Boston, Mass.		
S. F. Patterson, Concord, N. H.		
B. F. Pickering, Sanbornville, N. H.		
Fred C. Rand, Boston, Mass.		
F. A. Sherwin, Springfield, Mass.		
J. P. Snow, Boston, Mass.		
E. C. Spaulding, St. Johnsbury, Vt.		
Buffalo, Rochester & Pittsburg Railway	2	558
D. J. Carson, Du Bois, Pa.		
E. J. Govern, Rochester, N. Y.		
Canada Atlantic Railway	1	468
George A. Mountain, Ottawa, Ont.		
Canadian Pacific Railway	5	9,425
Henry Goldmark, Montreal, P. Q.		
F. P. Gutelius, Montreal, P. Q.		
C. N. Monsarrat, Montreal, P. Q.		
P. B. Motley, Montreal, P. Q.		
W. F. Tye, Montreal, P. Q.		
Central of Georgia Railway	2	1,878
H. C. McKee, Macon, Ga.		
M. F. Tucker, Americus, Ga.		
Central Railroad of New Jersey	1	646
A. L. Bowman, Jersey City, N. J.		

	Members.	Mileage.
Central Vermont Railway....................	4	536
J. E. Cole, St. Albans, Vt.		
C. F. Flint, St. Albans, Vt.		
H. E. Holmes, New London, Conn.		
G. J. Patterson, Waterbury, Vt.		
Chesapeake & Ohio Railway.................	2	1,627
J. M. Staten, Richmond, Va.		
C. W. Vandegrift, Ronceverte, W. Va.		
Chicago & Alton Railway....................	2	970
W. B. Causey, Bloomington, Ill.		
H. H. Eggleston, Bloomington, Ill.		
Chicago & Eastern Illinois Railroad..........	4	823
W. S. Dawley, Chicago, Ill.		
A. S. Markley, Danville, Ill.		
H. D. Perkins, Villa Grove, Ill.		
G. A. Wright, Danville, Ill.		
Chicago & North Western Railway...........	30	7,475
L. J. Anderson, Escanaba, Mich.		
F. L. Burrell, Fremont, Neb.		
Henry Crane (retired), Janesville, Wis.		
William Curtin, Boone, Ia.		
W. H. Finley, Chicago, Ill.		
H. W. Fletcher (retired), Allegheny, Pa.		
M. J. Flynn, Chicago, Ill.		
W. C. Halsey, Eagle Grove, Ia.		
John Hunciker, Chicago, Ill.		
J. W. Irwin, Chadron, Neb.		
Lee Jutton, Chicago, Ill.		
C. F. King, Norfolk, Neb.		
C. A. Lichty, Fond du Lac, Wis.		
George Loughnane, Mason City, Ia.		
A. W. Merrick, Boone, Ia.		
H. P. Morrill, Madison, Wis.		
H. Rettinghouse Boone, Ia.		
E. F. Reynolds, Antigo, Wis.		
M. Riney, Baraboo, Wis.		
J. S. Robinson, Chicago, Ill.		
D. Rounseville, Kaukauna, Wis.		
R. C. Sattley, Winona, Minn.		
I. F. Stern, Chicago, Ill.		
B. J. Sweatt, Boone, Ia.		

	Members.	Mileage.
W. J. Towne, Chicago, Ill.		
H. M. Trippe, Chicago, Ill.		
H. A. Walden, Boone, Ia.		
W. D. Walden (retired), Clinton, Ia		
A. E. Winter, Escanaba, Mich.		
C. C. Witt, Chicago, Ill.		
Chicago, Burlington & Quincy Railway, and K. C., St. Jo. & C. B. Railway..............	4	8,625
E. M. Gilchrist, Centerville, Ia.		
L. F. Goodale, St. Louis, Mo.		
W. Hurst, St. Joseph, Mo.		
J. O. Thorne, Beardstown, Ill.		
Chicago Great Western Railway.............	1	1,367
A. Munster, St. Paul, Minn.		
Chicago, Indianapolis & Louisville Railway...	1	536
J. M. Caldwell, Lafayette, Ind.		
Chicago, Milwaukee & St. Paul Railway.......	6	7,024
A. J. Hart, Minneapolis, Minn.		
N. H. La Fountain, Chicago, Ill.		
C. F. Loweth, Chicago, Ill.		
W. E. Smith, Chicago, Ill.		
Fred E. Weise, Chicago, Ill.		
A. Yappen, Milwaukee, Wis.		
Chicago, Rock Island & Pacific Railway.......	4	7,347
McClellan Bishop, Chickasha, I. T.		
E. R. Floren, Fairbury, Neb.		
F. L. Park, Topeka, Kan.		
J. D. Upp, Colorado Springs, Col.		
Chicago, St. Paul, Minneapolis & Omaha Railway	3	1,696
G. Larson, Itasca, Wis.		
J. W. McCormack, Altoona, Wis.		
W. B. Rogers, Emerson, Neb.		
Chicago Terminal Transfer Railroad.........	1	259
E. N. Layfield, Chicago, Ill.		
Cincinnati, Hamilton & Dayton Railway......	2	1,025
J. W. Anderson, Chillicothe, O.		
I. F. White, Dayton, O.		

	Members.	Mileage.
Cincinnati Northern Railroad................	1	236
J. M. Wilkinson, Van Wert, O.		
Colorado & Southern Railway................	1	1,134
W. T. Powell, Denver, Col.		
Colorado Springs & Cripple Creek Dist. Ry....	1	75
B. A. Briggs, Cripple Creek, Col.		
Denver, Enid & Gulf Railroad................	1	120
J. D. Lacy, Enid, Okla.		
Denver, Kansas & Gulf Railroad..............	1	25
H. M. Henson, Kiowa, Kan.		
Duluth & Iron Range Railroad...............	1	161
R. Angst, Duluth, Minn.		
Duluth, Missabe & Northern Railway.........	1	217
W. A. McGonagle, Duluth, Minn.		
Duluth, South Shore & Atlantic Railway......	1	583
W. M. Noon, Marquette, Mich.		
Elgin, Joliet & Eastern Railway, and Chicago, Lake Shore & Eastern Railway.............	2	386
A. Montzheimer, Joliet, Ill.		
G. F. Powers, Joliet, Ill.		
El Paso & Northeastern Co..................	2	810
Bailey J. Mustain, El Paso, Tex.		
Sam Mustain, Alamogordo, N. M.		
Erie Railroad (and Chicago & Erie)..........	4	2,420
W. O. Eggleston, Huntington, Ind.		
Fred A. Knapp, Jersey City, N. J.		
Neil McLean, Huntington, Ind.		
W. H. Wilkinson, Elmira, N. Y.		
Florida East Coast Railway.................	1	497
E. K. Barrett, St. Augustine, Fla.		
Fort Smith & Western Railway..............	1	217
B. F. Beckman, Ft. Smith, Ark.		
Fort Worth & Denver City Railway...........	2	453
J. M. Mann, Fort Worth, Tex.		
O. J. Travis, Fort Worth, Tex.		

	Members.	Mileage.
Galveston, Harrisburg & San Antonio Railway	4	1,343
C. S. Corrigan, San Antonio, Tex.		
C. R. Morrill, El Paso, Tex.		
A. J. Ross, El Paso, Tex.		
H. Small, San Antonio, Tex.		
Galveston, Houston & Northern Railway and Texas & New Orleans Railroad.............	2	439
A. McDonald, Houston, Tex.		
C. A. Thanheiser, Houston, Tex.		
Georgia Railroad...........................	2	307
B. A. Guill, Camok, Ga.		
W. M. Robinson, Augusta, Ga.		
Gila Valley, Globe & Northern Railway.......	1	125
C. C. Mallard, Globe, Ariz.		
Grand Rapids & Indiana Railway.............	1	599
W. S. McKeel, Grand Rapids, Mich.		
Grand Trunk Railway System...............	6	4,639
Ebenezer Brown, Allandale, Ont.		
A. Findley, Montreal, P. Q.		
George A. Mitchell, Toronto, Ont.		
A. E. Patton, Montreal, P. Q.		
R. K. Ross, Ionia, Mich.		
K. J. C. Zinck, Montreal, P. Q.		
Gulf, Colorado & Santa Fé Railway..........	4	1,434
S. F. Clapp, Temple, Tex.		
E. C. George, Beaumont, Tex.		
K. S. Hull, Beaumont, Tex.		
L. D. Smith, Galveston, Tex.		
Halifax & Southwestern Railway.............	1	195
L. H. Wheaton, Bridgewater, N. S.		
Illinois Central Railroad....................	9	4,431
C. C. Bean, Freeport, Ill.		
F. O. Draper, Freeport, Ill.		
T. J. Fullem, Chicago, Ill.		
R. J. McKee, Carbondale, Ill.		
Samuel P. Munson, Mattoon, Ill.		
William Reed, Jr., Carlinville, Ill.		
C. E. Thomas, Cent. Sta., Chicago, Ill.		
W. C. Waggoner, Princeton, Ky.		
E. F. Wise (retired), Waterloo, Ia.		

	Members.	Mileage.
Illinois Southern Railway....................	1	135
G. O. Lilly, Sparta, Ill.		
Intercolonial Railway.........................	8	1,467
T. C. Burpee, Moncton, N. B.		
John Forbes, Moncton, N. B.		
Hugh Jardine, Moncton, N. B.		
A. E. Killam, Moncton, N. B.		
H. I. McGrath, Moncton, N. B.		
W. B. McKenzie, Moncton, N. B.		
Thomas Sefton, Moncton, N. B.		
A. C. Selig, Moncton, N. B.		
International & Great Northern Railway......	1	1,144
H. M. Jack, Palestine, Tex.		
Jacksonville & St. Louis Railway.............	1	121
B. F. Bond, Jacksonville, Ill.		
Kansas City, Clinton & Springfield Railway...	1	248
J. B. Brown, Clinton, Mo.		
Kansas City Southern Railway...............	1	762
V. K. Hendricks, St. Louis, Mo.		
Lake Erie & Western Railway................	1	719
J. N. Penwell, Tipton, Ind.		
Lake Shore & Michigan Southern Railway....	4	1,529
Willard Beahan, Cleveland, O.		
Philip J. O'Neil, Adrian, Mich.		
B. R. Leffler, Cleveland, O.		
R. H. Reid, Cleveland, O.		
Lehigh & Hudson River Railway.............	1	91
J. E. Barrett, Warwick, N. Y.		
Lehigh Valley Railroad......................	8	1,434
E. B. Ashby, South Bethlehem, Pa.		
Walter G. Berg, New York City.		
W. E. Harwig, Phillipsburg, N. J.		
R. L. Heflin, Sayre, Pa.		
Judson Joslin, Auburn, N. Y.		
David A. Keefe, Athens, Pa.		
F. E. Schall, South Bethlehem, Pa.		
J. Van der Hoek, Buffalo, N. Y.		

	Members.	Mileage.
Long Island Railroad........................	1	392
J. H. Cummin, Jamaica, N. Y.		
Louisville & Nashville Railroad..............	2	4,290
Floyd Ingram, Erin, Tenn.		
A. B. McVay, Evansville, Ind.		
Maine Central Railroad......................	1	821
P. N. Watson, Brunswick, Me.		
Michigan Central Railroad...................	5	1,770
S. D. Bailey, Detroit, Mich.		
Charles Carr, Jackson, Mich.		
Thomas Hall, St. Thomas, Ont.		
Henry A. Horning, Niles, Mich.		
J. T. Webster, St. Thomas, Ont.		
Minneapolis & St. Louis Railroad.............	1	823
Ed. Gagnon, Minneapolis, Minn.		
Minneapolis, St. Paul & Sault Ste. Marie Railway	2	2,159
A. Amos, Minneapolis, Minn.		
P. Swenson, Minneapolis, Minn.		
Missouri, Kansas & Texas Railway..........	2	3,043
F. W. Bailey, Denison, Tex.		
J. G. Gossett, Denison, Tex.		
Missouri Pacific Railway System.............	10	6,340
(Including St. L., I. M. & S.)		
Robert J. Bruce, St. Louis, Mo.		
E. Fisher, St. Louis, Mo.		
F. W. Hausgen, Pacific, Mo.		
U. A. Horn, Osawatomie, Kan.		
T. S. Leake, St. Louis, Mo.		
J. O. Potts, St. Louis, Mo.		
F. B. Scheetz, St. Louis, Mo.		
W. T. Schültz, St. Louis, Mo.		
F. W. Tanner, St. Louis, Mo.		
L. J. Wackerle, St. Louis, Mo.		
Miss. River & Bonne Terre Railway..........	1	46
C. H. Fake, Bonne Terre, Mo.		
Mobile & Ohio Railroad......................	2	912
E. P. Hawkins, Okolona, Miss.		
C. A. Pigford, Meridian, Miss.		

	Members.	Mileage.
Nashville, Chattanooga & St. Louis Railway..	1	1,212
I. O. Walker, Paducah, Ky.		
New Orleans Terminal Co....................	1	23
Frank G. Jonah, New Orleans, La.		
New South Wales Government Railways.....	1	3,138
James Fraser, Sydney, N. S. W.		
New York Central & Hudson River Railroad..	9	3,205
William Kleefeld, Jr., Watertown, N. Y.		
G. J. Klumpp, Rochester, N. Y.		
J. F. Lantry, Weehawken, N. J.		
R. P. Mills, Mott Haven, N. Y.		
Kamper Peabody, Mott Haven, N. Y. City.		
W. A. Pettis, Rochester, N. Y.		
Edward Rykenboer, Rochester, N. Y.		
H. C. Thompson, Weehawken, N. J.		
E. E. Wilson, Mott Haven, N. Y. City.		
New York, Chicago & St. Louis Railroad.....	1	523
James Rogers, Fort Wayne, Ind.		
New York, New Haven & Hartford Railroad...	12	2,046
Grosvenor Aldrich, Readville, Mass.		
J. S. Browne, Providence, R. I.		
H. K. Higgins, Boston, Mass.		
William H. Keene, Hartford, Conn.		
Wm. H. Moore, New Haven, Conn.		
H. W. Phillips, South Braintree, Mass.		
L. H. Porter, Franklin, Mass.		
George A. Rodman, Providence, R. I.		
George T. Sampson, Boston, Mass.		
D. W. Sharpe, New London, Conn.		
J. B. Sheldon, Providence, R. I.		
Charles A. Sibley, New Haven, Conn.		
New Zealand Government Railways..........	3	2,291
C. H. Biss, Auckland, New Zealand.		
James Burnett, Wellington, New Zealand.		
George C. Troup, Wellington, New Zealand.		
Northern Pacific Railway....................	6	5,305
James Hartley, Staples, Minn.		
N. F. Helmers, Staples, Minn.		
F. Ingalls, Jamestown, N. D.		
B. T. McIvers, St. Paul, Minn.		

	Members.	Mileage.
J. C. Taylor, Glendive, Mont.		
Louis Yager, Minneapolis, Minn.		
Ohio River & Columbus Railway.............	1	24
George C. Millett, Ripley, O.		
Oregon Short Line Railroad.................	1	1,377
A. H. King, Salt Lake City, Utah.		
Pacific Coast Co., The......................	1	152
H. W. Bassett, Seattle, Wash.		
Pennsylvania Lines West of Pittsburg........	5	2,721
S. Geary, Cambridge, O.		
C. M. Large, Jamestown, Pa.		
A. F. Miller, Chicago, Ill.		
D. G. Musser, Wellsville, O.		
D. C. Zook, Fort Wayne, Ind.		
Pennsylvania Railroad	2	5,190
Robert McKibbon, Pittsburg, Pa.		
C. W. Richey, Pittsburg, Pa.		
Pere Marquette Railroad....................	2	2,398
G. E. Hanks, Saginaw, Mich.		
A. McNab, Holland, Mich.		
Philadelphia & Reading Railway.............	2	1,475
John Foreman (retired), Pottstown, Pa.		
W W. Perry, Willamsport, Pa.		
Pittsburg & Lake Erie Railroad..............	2	191
D. L. McKee, McKee's Rocks, Pa.		
G. H. Soles, Pittsburg, Pa.		
Portland & Rumford Falls Railway...........	1	68
C. S. Osgood, Rumford Falls, Me.		
Quebec & Lake St. John Railway.............	1	241
A. E. Doucet, Quebec, Que.		
Rutland Railroad	1	416
J. E. Johnson, Rutland, Vt.		
St. Joseph & Grand Island Railway..........	1	313
O. H. Andrews, St. Joseph, Mo.		
St. Louis & San Francisco Railroad...........	1	5,086
Samuel Boutin, Cape Girardeau, Mo.		
St. Louis, Iron Mountain & Southern (see Missouri Pacific System).		

	Members.	Mileage.
St. Louis, Kansas City & Colorado Railroad...	1	298
B. M. Hudson, Union, Mo.		
St. Louis Southwestern Railway............	1	1,309
J. S. Berry, Tyler, Tex.		
San Antonio & Aransas Pass Railway........	1	724
William Berry, Yoakum, Tex.		
South & Western Railway..................	1	154
William F. Steffens, Johnson City, Tenn.		
Southern Railway	7	7,492
James T. Carpenter, Princeton, Ind.		
William A. Fort, Columbia, S. C.		
O. D. Killebrew, Columbia, S. C.		
J. S. Lemond, Charlotte, N. C.		
D. W. Lum, Washington, D. C.		
J. W. Morgan, Columbia, S. C.		
G. W. Welker, Alexandria, Va.		
Southern Pacific Company..................	7	5,971
Frank V. Carman, West Oakland, Cal.		
R. M. Drake, San Francisco, Cal.		
Thomas Humphreys, Bakersfield, Cal.		
F. W. Lloyd, Oakland Pier, Cal.		
W. J. Mellor, Algiers, La.		
George W. Rear, San Francisco, Cal.		
Daniel Robertson, West Oakland, Cal.		
Temiskaming & Northern Ontario Railway....	1	113
W. B. Russell, North Bay, Ont.		
Texas & New Orleans Railroad, and Galveston, Harrisburg & San Antonio Railway.........	1	1,782
A. McDonald, Houston, Tex.		
Texas & Pacific Railway...................	1	1,833
E. Loughery, Marshall, Tex.		
Texas Midland Railroad....................	1	125
E. H. R. Green, Terrell, Tex.		
Tide Water Railway........................	1	332
John I. Banks, Norfolk, Va.		
Toledo, Peoria & Western Railway..........	1	248
J. H. Markley, Peoria, Ill.		

	Members.	Mileage.
Toledo, St. Louis & Western Railroad........	1	450
A. Shane, Frankfort, Ind.		
Union Pacific Railroad......................	5	2,956
J. C. Beye, Kansas City, Mo.		
J. H. Howe, Omaha, Neb.		
J. L. Neff, Omaha, Neb.		
J. Parks, Denver, Col.		
F. C. Stimson, Council Bluffs, Iowa.		
Wabash Railroad	3	2,516
A. C. Blake, Moberly, Mo.		
A. O. Cunningham, St. Louis, Mo.		
William S. Danes, Peru, Ind.		
Wellington & Manawata Railway (New Zealand)	1	84
Arthur Williams, Wellington, New Zealand.		
Western Australia Government Railways.....	2	1,516
W. J. George, Perth, Western Australia.		
E. S. Hume, Fremantle, Western Australia.		
Wisconsin Central Railway..................	1	1,022
Henry Bender, Fond du Lac, Wis.		
Miscellaneous	30	
	340	185,479

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TO REPORTS AND DISCUSSIONS ON TECHNICAL SUBJECTS AT THE SIXTEENTH ANNUAL CONVENTION.

REPORT OF COMMITTEES ON INVESTIGATION, 1905–1906.

COMMITTEES ON SUBJECTS FOR REPORT AND DISCUSSION.

REPORTS AND DISCUSSIONS ON STANDING SUBJECTS.

LIST OF ILLUSTRATIONS.

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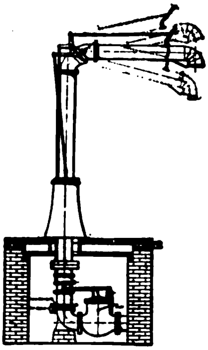
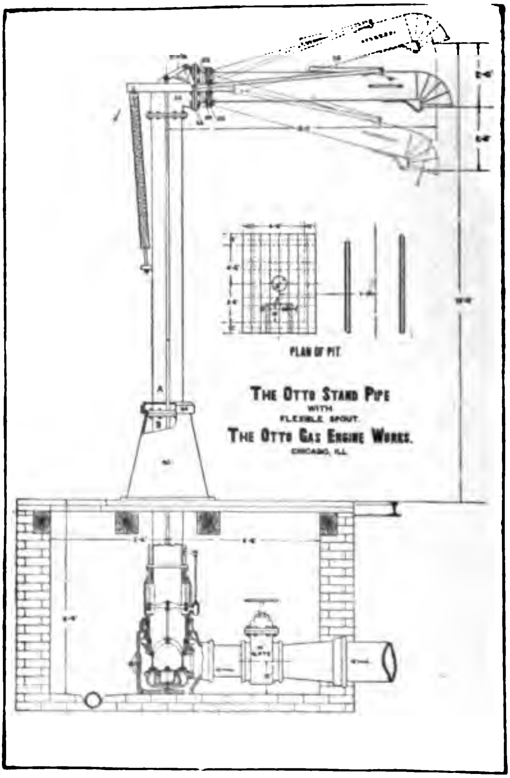



ALTITUDE

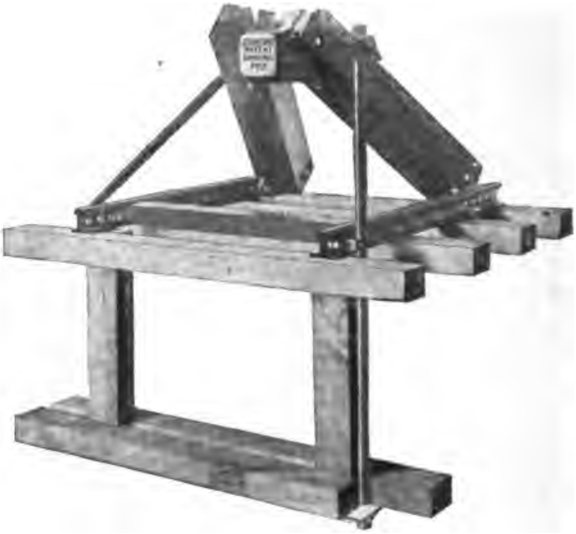

PLAN OF PIT
THE OTTO STAND PIPE
WITH
FLEXIBLE SPOUT.
THE OTTO GAS ENGINE WORKS.
CHICAGO, ILL.

The Stanford PATENT Bumping Post

ILLUSTRATION OF WHICH IS SHOWN, IS NOW BEING HANDLED BY

The RAILROAD SUPPLY COMPANY, CHICAGO

They claim the following special advantages of this post over others now on the market:



POSITION

Timbers are set forward at an angle of 45 degrees and anchor rods are set backward at an angle of 45 degrees, giving the best position possible to resist a blow. No other bumper so constructed.

DISTRIBUTION OF BLOW

The blow is resisted, or absorbed, at four different points, each anchor rod and each timber sustaining one fourth of the blow given. This distributes the strain with the result that each part of the bumper does its respective share of the work.

FOUNDATION

Inclined timbers are supported directly upon the rails, distributing the pressure over several ties.

ANCHORAGE

The 2¼-inch anchor rods are secured to wrought iron cross-plate on the back of timbers, the anchor rods running through heavy malleable clips secured by "U" bolts to the rail, extending below rails and anchored at lower end four feet below the surface of the track.

The anchor rods pass through two malleable iron cross-brackets upon which rest two ordinary ties.

As an additional element of strength, two vertical or upright heavy oak struts rest upon the anchor ties and are set under the base of the rail, preventing movement of anchorage timbers.

Anchor rods are not threaded but ends are upset giving full strength of the 2¼-inch rod. At their upper end a divided washer is used, and at their lower end a divided bracket which fits under the heads of anchor rods. The divided washers are bolted together and find their bearing on cross-plate. The divided brackets are also bolted together and the anchor ties rest upon them.

SPACER

An oak spacer is used to hold the rails to the proper gauge against the inward pressure of anchor rods.

TIE ROD

A wrought iron tie rod secures the rails to their proper gauge against the outward thrust of the timbers.

ADVANTAGES

Is applicable to standard gauge railroad track without special preparation or cutting of rails.

No other bumping post is designed to clear pilot of locomotive.

This bumping post being founded upon the rails, prevents creeping.

Wisconsin Bridge & Iron Company, Milwaukee, Wisconsin